AMERICAN MACHINIST

October 29, 1941

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Better Than Men?—*Vultee Aircraft has found that many a girl is a better man than her father was, providing she is put on work that fits her capabilities*

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COMING TO YOU NOVEMBER 26

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WHAT'S IN THIS ISSUE

R. A. LAWSON

Wendell Willkie chats with women workers in the Vultee Aircraft plant on a recent inspection trip

A. ROUSSEAU

WOMEN'S PART

What part will women play in the present crisis? We know that English women are in the thick of it—in the army, navy and the various auxiliary corps for farm and industrial work. Vultee Aircraft, Inc., has been experimenting with women workers for over a year and has found them efficient. R. A. Lawson, Vultee's works manager, tells about it on page 1106, in a timely article "Women at Work."

HOW FAST CARBIDES?

Cemented carbides cut faster than other tool materials, but there's a limit. If the speed is too slow the work tears; too fast and it glazes. A practical test for the right speed is described by R. H. McCormick, of Vascoloy-Ramet. Turn to page 1090 for his "Critical Speeds for Carbides."

HEAT-AND-MOVE

Rupert LeGrand, our Detroit editor, continues his summary of mechanized furnaces. In this installment, he discusses overhead track and chain conveyor furnaces. Part 2 of his four-part article appears on page 1084.

MILLING SPEEDS

It's easy to understand why our Reference Book Sheets are so popular. They are crammed with factual data that the production man needs but is too new to be found in any handbook. Here we have another pair on recommended speeds for milling machine operations as compiled by the Cincinnati Milling Machine Company. See pages 1111 and 1113.

FLAME-HARDENING EQUIPMENT

A big part of successful flame hardening is to know just what equipment is available for the purpose. J. G. Magrath, Air Reduction Company, devotes a good portion of the tenth installment of his series to this subject. If you have been following his enlightening treatment of this process you want to know what he says beginning page 1087.

F. G. SCHRANZ

SHELL FORGING

Along with a lot of other plants, Baldwin Locomotive is doing its bit for the armament program. Among other things it's making shell and naturally enough uses the Baldwin-Omes forging process which employs a square-sectioned billet. F. G. Schranz, general manager, Baldwin-Southwark Division, who knows as much as anyone about the subject, tells on page 1095 just how they turn out 155-mm. shell in quick time.

OUT OF THE TOOLROOM

Thread grinding used to be reserved for taps and other precision tool work—but no more; the process has jumped right into the production line. Standard thread-grinding machines are now available. But to get the best from the process you must use the right wheel. How do you select it? Read "Wheels for Thread Grinding," page 1081, by A. Rousseau, of the Norton Company.

MORE ON LINKS

Some months ago (*AM*—Vol. 82, page 435) we devoted an Armament Section to "Cartridge Links for Machine Guns." Some improvement has been made in the heat-treating process. To keep you up-to-date we devote page 1105 of the present section to a description of the new method.

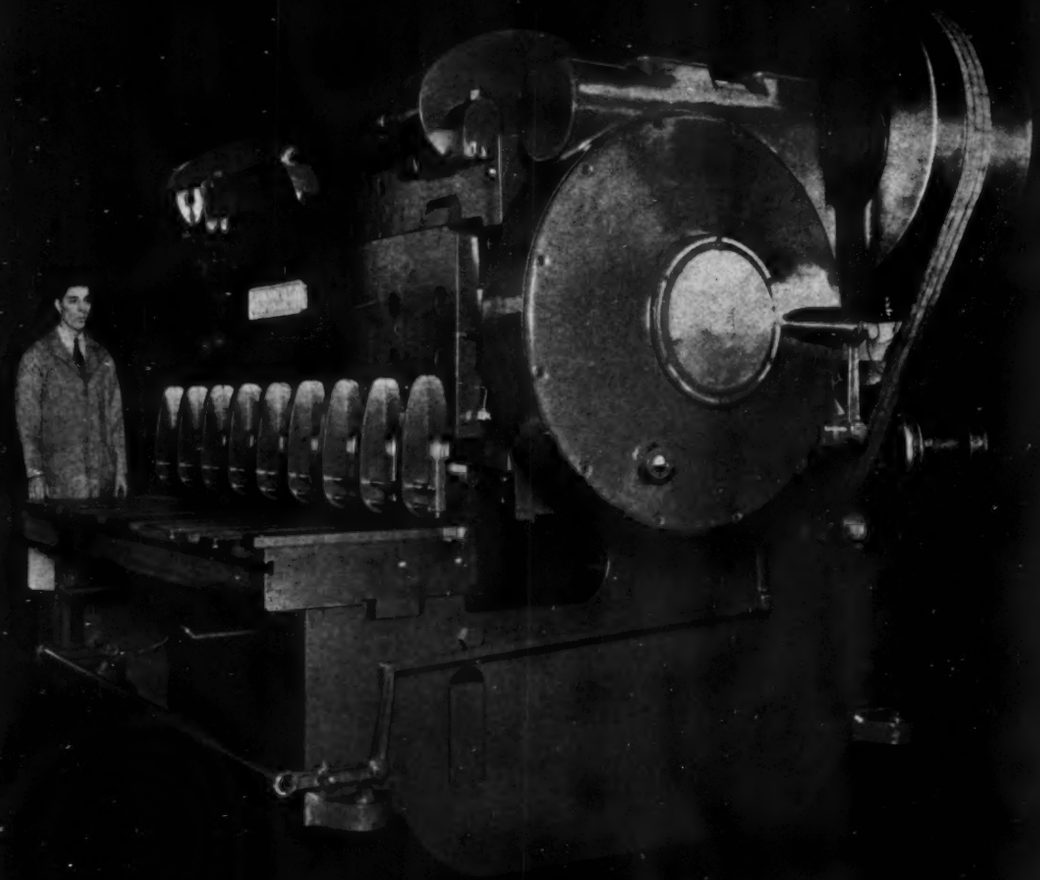
COMING

With so many things happening at once, an editor doesn't always know which way to turn. One sure guide is readers' requests, and lately the subject of training is in demand. Ever anxious to please, we will run shortly a detailed story on General Motors' training methods. Be sure to look for it if you're faced with the problem of putting unskilled men to work. And, by the way, if you have any more requests, send them along.

ARMOR PLATE

. . . Shear it on Cincinnati Shears

Write for recommendations based on experience in building Cincinnati All-Steel Shears for arsenals, navy yards, and manufacturers of armament.



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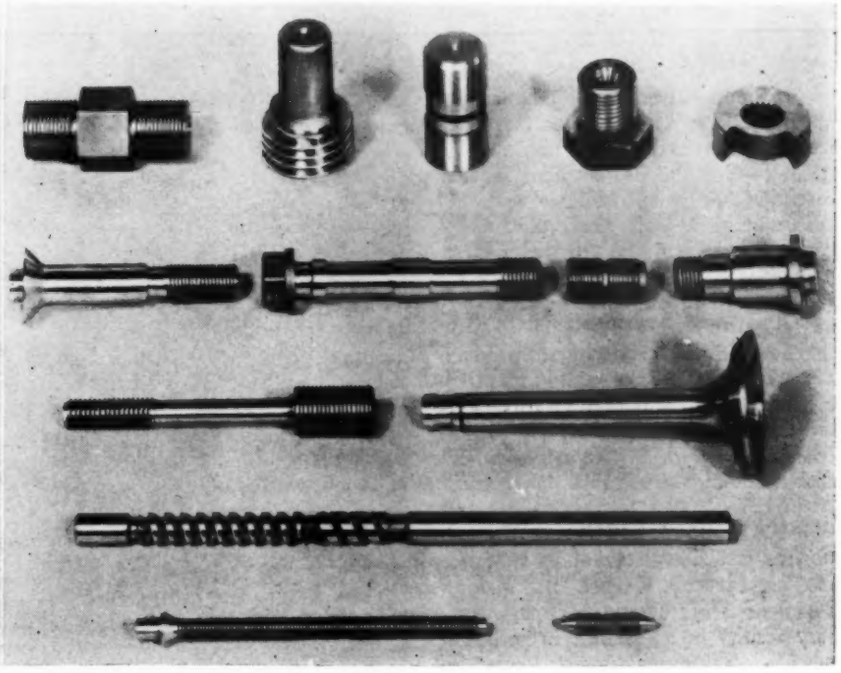
ESTABLISHED 1877 **AMERICAN MACHINIST** BURNHAM FINNEY, Editor

Wheels For Thread Grinding



BY A. ROUSSEAU, NORTON COMPANY

What do you want in a thread? Precision or high production? These are only two of the many factors that affect grinding wheel selection and application

TO CRITICIZE and specify wheels intelligently for any grinding operation, it is necessary to have some understanding of how the abrasive wheel constituents and properties, such as bond, grit size and grade of hardness, affect the grinding action and the results obtained. This is particularly true where the quality of thread, surface finish and rate of production are bound up closely with the grinding wheel.

Wheels used for grinding threads use two different types of bond, vitrified and resinoid. Their grinding characteristics are quite different. Vitrified bonded wheels are more rigid, hold their alignment better—an important requirement for extreme accuracy. Vitrified wheels should be selected where accuracy of lead is a primary requisite. When grinding long threads with vitrified wheels, there is little chance of progressive lead error as might occur from the gradual building up of side pressure.

If vitrified wheels can produce the most accurate threads, why should any other wheel ever be used since all thread grinding must be held to relatively close limits? The answer is that vitrified wheels are likely to fail if pushed even slightly beyond their capacity; this limits their practical application to those jobs where extreme accuracy is more important than maximum rate of production.

Resinoid bonded wheels hold their edge better, particularly on high production work such as studs, screws and other parts held to commercial tolerances. They will resist more abuse and produce a brighter finish, but being less rigid, they are more likely to follow a lead error in a precut thread; they may even generate a lead error, especially toward the end of a cut where the wheel is not fully supported on both sides.

While resinoid bonded wheels are employed successfully in a number of plants for producing high grade taps and thread gages, this is an exception to the general rule. Simply changing to vitrified wheels on certain jobs has been the means of correcting lead error trouble experienced with resinoid bonded wheels. The improvement is usually greater when grinding the coarser pitches where heavy cuts are employed.

General rules on the choice of bond may be summarized as follows:

Use vitrified bonded wheels wherever close tolerances are required either in form or lead. This includes such parts as gages, leadscrews and high grade taps, especially if precut. Also use vitrified wheels for worms where several cuts with light feed are taken. Use vitrified wheels for internal grinding.

Use resinoid bonded wheels on high production jobs, where it is desirable to finish the parts with the fewest possible cuts and at high work speed but where extreme accuracy is not required. This would include a multitude of small studs and screws of various kinds, adjusting screws which are not calibrated, many classes of taps and other work produced in large quantities.

Grit size is controlled largely by the pitch of the thread to be ground. Tables

MAXIMUM OPERATING SPEEDS RECOMMENDED BY NORTON COMPANY

		(Ex-Cell-O) 18 x 3/8 x 9 in.	(Jones & Lamson) 20 x 3/8 x 10 in.
Vitrified 80 and finer	Grade H	1,700 r.p.m.	1,530 r.p.m.
	" I	1,910 "	1,720 "
	" J and harder	2,000 "	2,290 "
Resinoid 80 and finer	Grade O and harder	2,545 "	2,290 "

of grinding wheel recommendations have been drawn up based on this rule. Recently, however, there has been a trend toward the use of finer wheels than this rule would indicate.

A likely explanation is that many concerns are grinding threads with a much narrower root than required by the standard thread form. This standard allows a root width equal to $\frac{1}{8}$ of the lead, yet many shops try to produce as narrow a root as possible regardless of the pitch. If it is necessary to maintain a narrower root width than called for by the standard, then a finer wheel than recommended in most tables must be used.

It should be remembered that reduction of grit size also reduces stock removing capacity. Hence, the maintenance of a narrower root than necessary results in a sacrifice in grinding efficiency. Compensation for this can be made to some extent by employing higher wheel speeds; this is done in several plants, but the maintenance of extremely high wheel speeds is sometimes objectionable for mechanical reasons. A skilled operator with good truing diamonds can use a coarser wheel for a thread of given pitch than is possible with less skill or with a worn diamond.

Effect of Stock to be Ground

There is some evidence that the nature of the material being ground has an influence on the selection of grit size. Recent observations seem to indicate that high-speed steel and other very hard steels (55 Rockwell and harder) can be ground better with finer wheels even though the threads are relatively coarse. In one instance, a 180-grit medium grade aluminous vitrified wheel showed little or no burning while a 120-grit soft grade wheel of the same type burned badly under similar conditions. The material was high-speed steel. It is quite possible that the finer grains penetrated the hard material more easily as has been observed on other classes of grinding.

After selecting the proper grit size to meet the root width and finish requirements, the next factor to consider is the grade of hardness of the wheel. This is determined more by the grit size than anything else. There seems to be an optimum grade for each grit size regardless of other factors. Aluminous abrasive vitrified wheels of 120 grit and a soft grade are widely used for a great variety of work, but apparently 120-grit wheels are not suitable in any other but a soft grade. The same is true of other grain and grade combinations. Contrary to practice on cylindrical and other conventional grinding operations, the finer grits seem to call for harder grades although there is some overlapping. The following table shows the grades (based on grading system used by most grinding wheel manufacturers) most commonly associated with various grit sizes:

Vitrified		*Resinoid*	
Grit Size	*Grade*	*Grit Size*	*Grade*
80	I	100	S
120	J	120	S
150	K	150	Y and U
180	M	180	U
220	P		

It is interesting to note that this relatively limited assortment of specifications is sufficient to take care of practically every ordinary thread-grinding requirement from the coarsest pitch down to 48 pitch. Some modifications may be desirable to obtain maximum efficiency for certain specific conditions.

Thread grinding wheels, both vitrified and resinoid bonded, are being operated at speeds ranging from 6,500 to 12,000 surface ft. per min. Increasing the wheel speed seems to increase the stock removing ability of a fine grit wheel. If a fine wheel has been selected in order to maintain a narrow root and if the pitch is relatively coarse so that considerable stock removal is called for, it will probably be necessary to use a high wheel speed. Where coarser grit wheels, such as 120 and coarser, are used, the higher speeds are not necessary and probably would not work as well.

RELATIONSHIP OF GRIT SIZE TO ROOT WIDTH

Root Width Inch	Grit Size Vitrified Wheels	Grit Size Resinoid Wheels
0.003	220	180
0.004	180	150
0.005	150	120
0.006	120	120
0.007	120	100
0.008	100	100
0.009	100	90
0.010	90	90

In one plant, where studs and miscellaneous threaded parts are being turned out on a high production basis, a 150-grit, grade U resinoid wheel is being operated at 12,000 surface ft. per min. The high speed seems to render this relatively fine grit wheel almost universal in its application. It will hold a narrow edge; yet it removes stock rapidly. The pitch of the threads ground ranges from 11 to 32. A coarser wheel would not hold such a narrow edge and at a slower speed the fine grit would not be capable of removing stock so fast. Most of the work is steel, but considerable aluminum and cast iron is also ground.

Where Low Speeds Are Best

On high-speed steel and other sensitive steels lower speeds are usually advantageous. Lower speeds are also better where quality of finish is important.

The principal objections to high wheel speeds are difficulty in preventing chatter, difficulty in confining oil to the point of operation and increased amount of oil mist and splash. High wheel speeds also increase truing diamond wear.

Work speed and feed must be considered together since they jointly determine the rate of production per unit of time. There is still considerable controversy over the relative merits of many passes with light feed at high work speed and few passes with heavy feed at low work speed. Various combinations can be found which will produce a given amount of work in approximately the same unit of time. As a rule, the light feed, high work speed method calls for finer and harder wheels than if heavy feed and low work speed are employed.

On alloy steels and structural steels, which are tough rather than hard, slow work speeds and few passes are usually more economical. On material of this character pitches as coarse as 10 or 12 are sometimes ground from the solid in two passes and sometimes in a single pass at a work speed of $1\frac{1}{2}$ to 2 ft. per minute. Screws of 18 pitch and finer are often ground from the solid in a single pass.

In thread grinding, the wheel runs down at the point of contact with the work. The work, however, can run in either direction. Where the work rotates in the same direction as the wheel (as on a cylindrical grinder) the cut corresponds to the so-called "up-cut" on a milling machine. When the work runs in the opposite direction it corre-

Ex-Cell-O Corporation Photo

Vitrified wheels are frequently used on long threads because of their greater accuracy; resinoid wheels give higher production when working to commercial tolerances

sponds to a "climbcut." Where more than one pass is required to grind a thread, it is customary to grind the alternate passes with climbcut and up-cut rotation.

There is general agreement that the up-cut method produces a better finish, and where more than one cut is employed, the cycle is frequenty arranged to finish on the up-cut. There is some evidence to indicate that with the climb-cut method more heat is generated.

Where more than one cut is required to grind a thread, distribute the amount of feed between the cuts in order to obtain the best results. Guard against too heavy a roughing cut in the expectation that this will leave a minimum of work to do on the finishing cut. The point of the wheel is likely to break down on a heavy roughing cut, leaving an excessive amount of work for the point to do on the finishing cut. For example, on 12 pitch screws it has been found that approximately 0.036 in. for the roughing cut and 0.018 in. for the finishing cut (total depth of thread for 12 pitch standard screw is 0.054 in.) is a division which gives good results.

Thread grinding wheels must be carefully mounted and balanced if best results are to be obtained. At the high speeds usually employed, any slight deviation in the matter of trueness or balance is likely to show up in the quality of the work.

Care is exercised in the manufacture of thread grinding wheels to insure uniformity of structure and geometrical accuracy. After truing, these wheels are carefully tested for balance, and those which are not close enough for average conditions are "corrected" by various methods.

The requirements in many thread grinding jobs are so exacting that further correction by the user is frequently necessary and always recommended. After mounting the wheel in the wheel sleeve, it should be mounted in the grinding machine and carefully trued with the machine diamonds. The wheel (in the sleeve) should then be removed from the machine and balanced by adjusting the weight in the grooves on the flange. In balancing, the wheel should first be trued in the wheel sleeve.

Where several thread grinding machines are in use, it is sometimes advantageous to provide a special "truing machine" or lathe built to accommodate the wheel sleeve with proper diamond fixtures. This saves tying up the thread grinding machine while the wheel is being trued and balanced, and reduces diamond wear on the grinding machines. A number of extra wheel sleeves, in which the trued and balanced wheels can be stored until needed, are obviously required.

Avoid too heavy cuts when truing the wheel as they accelerate diamond wear and disturb the structure of the wheel near the edge so that it is likely to break down more rapidly than if more moderate cuts were taken.

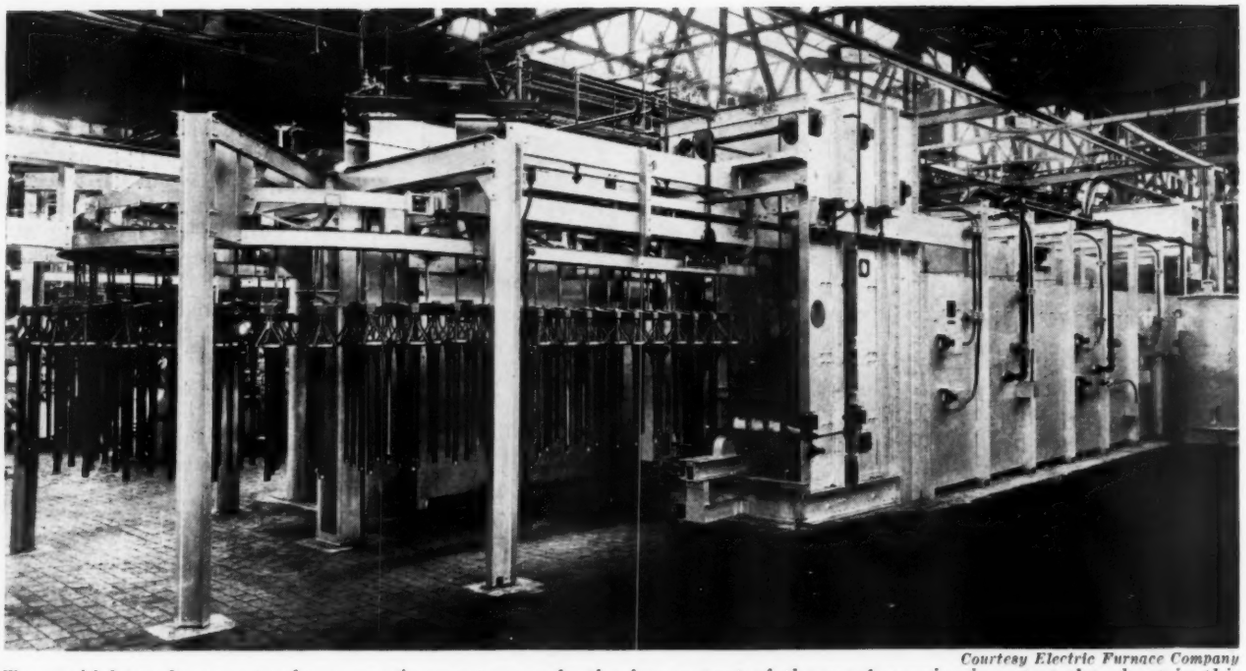
Most wheel sleeves are equipped with Vellumoid gaskets; where these are present, it is not necessary to use the blotting paper washers which come with the wheels. The wheels should never be mounted with the steel flanges in direct contact with their sides. Be sure the sides of the wheel as well as the flanges and the gaskets are clean and free from foreign material before mounting.

An adequate flow of grinding oil of proper quality is almost as important as the selection of the correct wheel. Changes in the grade of oil or in the adjustment or design of the nozzles have often marked the difference between success and failure on a job.

Several large oil companies are in position to supply satisfactory oil for thread grinding jobs. The design of oil nozzles to fit a given job is the function of the machine builder, possibly in collaboration with the oil technician.

A responsibility of the user is to keep the oil clean. Repeated cases are encountered where the settling tanks are not cleaned frequently enough. Users fail to realize how quickly large amounts of steel removed from the work accumulate. Good finish cannot be produced with contaminated oil, and the oil cannot properly keep the wheel free from loading if it is not kept reasonably clean. There are various filters and separators on the market, and where best results are desired, they should be investigated.

Some experimentation and trial may be necessary before arriving at the best wheel. The usual procedure is to select a wheel which has been found to be satisfactory on a similar job. The results obtained with this wheel can then be studied, and if not entirely satisfactory, a slight change in either the grit size or grade of the wheel, or perhaps one or more of the operating conditions, should bring about the desired results.



Courtesy Electric Furnace Company

To avoid heat damage to the conveying system, only the lower part of the work carrier is exposed to heat in this automatic axle hardening and drawing installation. Work carriers are suspended from roller crossbeams running in the overhead track. At the hardening furnace, an elevator removes the work carrier from the exposed track and engages it with a second track placed above the furnace roof. A slot in the roof permits passage of the hanger connecting the roller crossbeam and work carrier. At the end of the hardening furnace, a second elevator quenches the work for a specified length and replaces the carrier on the exposed track loop

Furnaces for Production Heat-Treating

BY RUPERT LE GRAND, DETROIT EDITOR, AMERICAN MACHINIST

2—Conveyor-type furnaces are often cheaper to operate than other types because of reduced part handling. Installation cost limits use to large-quantity jobs

OVERHEAD CHAIN and track conveyors find limited employment in mass-production heat-treating. The work must be such that it can be suspended from hooks or lugs cast integrally with the chain, or capable of suspension from carriers fastened to the chain or to rollers or pallets moving within an overhead track. Modern furnace designs of this type seek to prevent deterioration of the chain or track by disposing it above a longitudinal slot in the furnace roof and thus not subject to direct exposure to furnace temperatures. The carrier or hook passes down through the slot and may be branched at the lower end to carry several work pieces. Cost is reduced also because the chain or track need not be made of heat-resistant alloy. By proper layout, the conveyor can be utilized to act as a storage medium for heat-treated work and to transfer it to a distant unloading point. This may be in conjunction with the loading operation, in which case only a single operator may be required.

Where the overhead track system is used, the work carrier may be supported from roller crossbeams running in channel rails. The crossbeams are moved intermittently through the furnace by a suitable pusher mechanism. If pallets are employed, they slide within a track and are urged forward by a finger or pawl. Transfer mechanisms are incorporated in the conveying equipment so that the work carriers are taken from the exterior overhead track, lowered to the desired level for movement through the hardening furnace, dropped into the quench tank, lifted out of the quench and into a washer, next, moved into the drawing furnace and finally run out upon the cooling or storage portion of the conveyor loop. Several hours may be required for the complete cycle, during which the work is not handled.

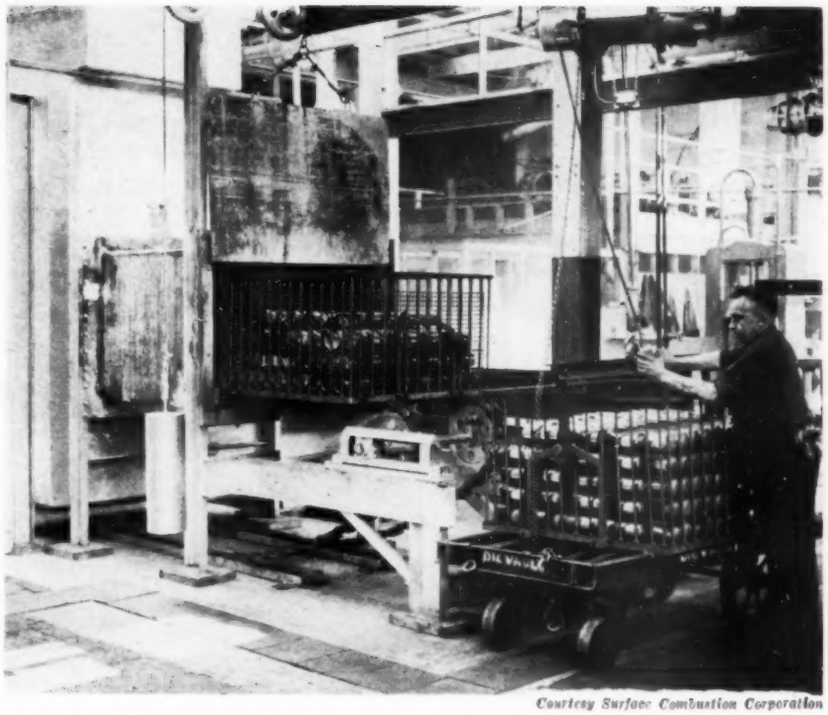
Such work as automobile axles, especially those in which only a portion of the axle is to be hardened, can be transported through the heat-treating cycles involved by means of overhead chain or track conveying systems. Pressed-steel bathtubs are vitreous enameled by the chain conveyor method. Because of the size of such

installations, they are commonly built as a separate structure, and the walls of the furnace are actually the exterior of what is really a large building in itself.

Chain conveyors are also employed to transport workpieces through furnaces in the horizontal position. In this construction, parallel strands of chain with integrally cast lugs or work supports are caused to run on sprockets at the front and rear of the furnace. Work loading and removal are convenient with this arrangement, but difficulty is experienced with uneven expansion and contraction of the two or more strands of chain required. Large round forging bars are normalized and axles are drawn in the horizontal position. Axles are frequently hardened in the vertical position to prevent warpage, but with modern screw-conveyor furnaces they are being hardened horizontally.

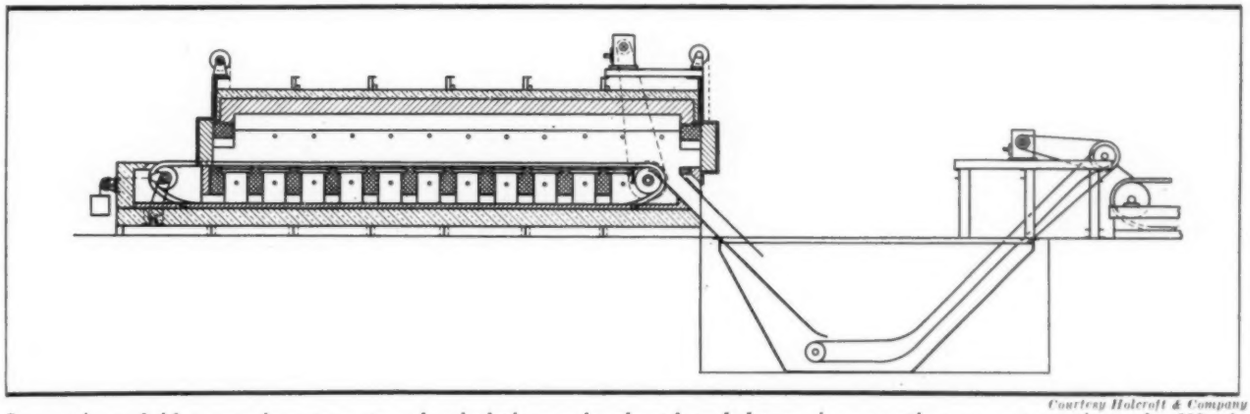
BELT CONVEYOR FURNACES

Belt-conveyor furnaces have a multiplicity of uses in connection with hardening, annealing and copper brazing operations in which the unit loadings are comparatively light per



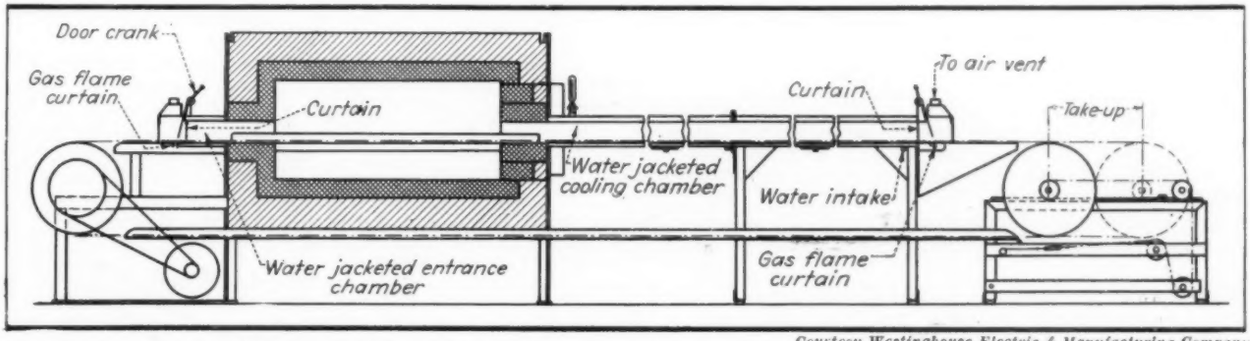
Courtesy Surface Combustion Corporation

Strands of chain operating within the furnace on sprockets are employed for transporting bars crosswise, axles lengthwise, and also baskets. In this installation, cartridge cases are being annealed between draws



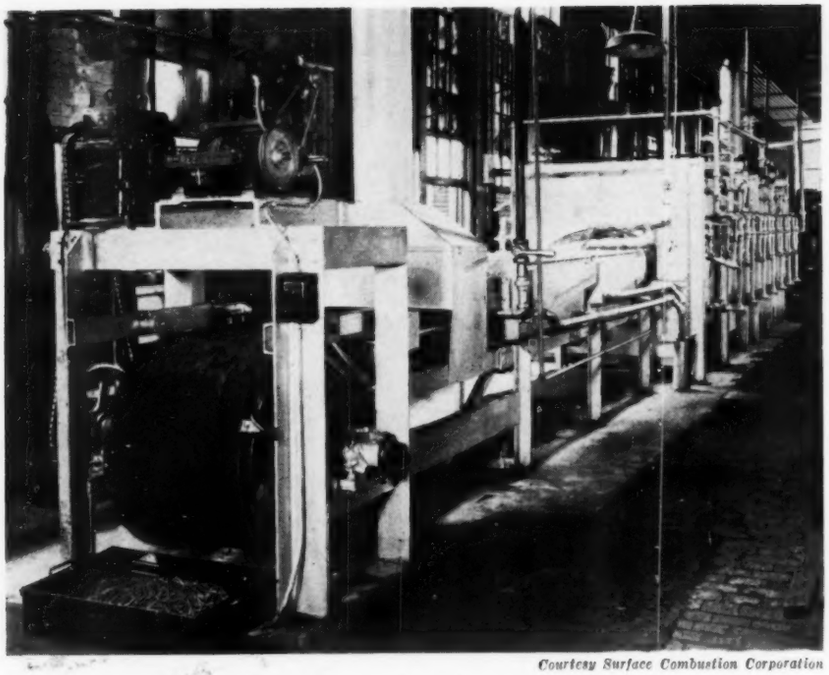
Courtesy Holcroft & Company

Long pieces laid crosswise upon strands of chain are hardened and drawn in a continuous automatic cycle. Workpieces are discharged into the quench and carried thence by elevator to the drawing furnace, not shown. Capacity of this installation is 2,500 lb. per hour



Courtesy Westinghouse Electric & Manufacturing Company

For copper brazing light assemblies and for bright annealing of coiled copper tubing, the belt must be exposed at the loading and discharge stations. An automatic belt take-up is essential to compensate for stretch in the heated portion of the belt, and the drive is placed at the loading station so that belt pull will be upon the cooled portion



Courtesy Surface Combustion Corporation

Discharge end of muffle furnace with wire-mesh belt conveyor for clean-hardening bolts. The belt returns beneath the furnace

square foot of hearth area. Despite their higher first cost and maintenance cost, belt furnaces are often cheaper to operate than other types because of reduced handling labor. Bolts and miscellaneous machined parts or stampings can be hardened or annealed with minimum expenditure of effort through intermittent feeding by means of a hopper, scoop, shaker tray or hand-operated charging tray. Assemblies for copper brazing are laid by the operators directly upon the exposed belt instead of stacking in trays. At the discharge end, copper-brazed assemblies can be removed by the operators of subsequent processing equipment. In the case of hardened work, automatic elevators can be arranged to discharge the work into barrels or tote boxes, or into washing equipment. Annealed work can frequently be discharged directly into containers.

Belts may consist of cast articulated-link chain with the surface practically closed or with voids up to one-third of the belt surface, mesh belts which have varying percentages of voids, or pressed-metal belts consisting of formed links which have been pinned together.

Cast-link belts are employed in widths from 12 to 36 in. for hardening operations. They are seldom used for copper brazing because their weight impairs strength at 2,050 F., plus high initial and replacement cost. Maximum loading is probably 35 lb. per sq. ft., but 10 lb. is common for hardening bolts.

Mesh belts are intended for lighter loads. For copper brazing, widths normally do not exceed 24 in. and unit loads more than 7 to 8 lb. per sq. ft., because assemblies are usually small and light. For annealing deep-drawn stampings and coils of copper tubing, however, belt widths approach 4 ft. as a maximum.

Fabricated belts weigh somewhat more than mesh belts, which is an important factor in determining the process application, permissable loading, and width. They find application in annealing copper cartridge cases for small-arms ammunition, and similar articles, and permit heavier loadings than mesh belts.

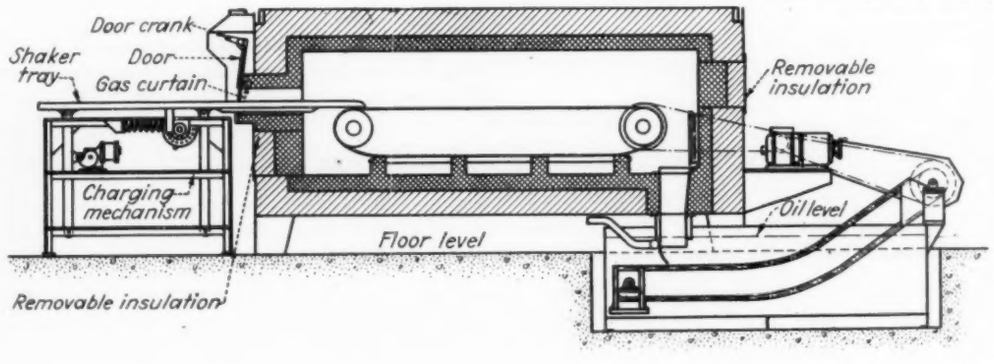
Selection of the type of belt suitable for a given application is primarily an engineering proposition. Each case must be decided upon a number of factors, among which are: (1) the process temperature and length of belt, the latter influencing the weight and therefore the permissable loading, (2) whether the belt is fully inclosed or leaves the furnace at the loading station and is therefore subject to alternate heating and cooling, and (3) relative initial and maintenance costs of the various types of belts.

Belt furnaces may have the belt exposed at one or more points or totally inclosed. In the first case, the belt is subject to deterioration from the effects of alternate heating and cooling, but an exposed loading station may be essential for proper work loading, especially in copper brazing. But where the parts permit "blind" loading onto a totally inclosed belt, added belt life and better furnace efficiency may be expected. Sight holes in the furnace wall permit the operator to check the character of feeding; doors allow removal of parts that may drop from the belt. Ordinarily, belt edges are turned up sufficiently to prevent loss of parts; otherwise, wiping elements or guards can be provided.

Standard belt-conveyor furnaces for scale-free hardening are built by one manufacturer in capacities from 80 to 1,200 lb. per hr. Specially engineered equipment has been built for 4,000 lb. of work per hour.

Part 3 of this article will appear in an early number.

Courtesy Westinghouse Electric & Manufacturing Company



For hardening small parts the mesh belt is totally inclosed to avoid deterioration from exposure to the atmosphere and loss of heat. Work feed may be by scoop, hand-operated or shaker tray projecting into the furnace, by hopper, or by special feeding device

Built-Up Surfaces and Apparatus

COMPILED BY J. G. MAGRATH, APPLIED ENGINEERING DIVISION, AIR REDUCTION COMPANY

Built-up surfaces may be flame hardened, too. To make best use of all phases of this process, a familiarity with available apparatus is most essential

BUILDING UP worn machine parts, not previously hardened, is a common operation. Added surface life may frequently be secured by flame hardening the built-up areas. A combination of building-up and flame hardening permits machining the built-up part to size before flame hardening.

Examples of such work are rail ends and frogs, caterpillar tractor rolls, sprocket and gear teeth, strip mill guides and guide ways, crane track wheel treads and locomotive radial buffers.

Gas welding rods or electrodes of the proper carbon content should be selected of an analysis to match most nearly that of the base metal and to provide sufficient carbon content for flame hardening. The loss of carbon and greater loss of manganese in welding must be taken into consideration for each of the gas welding rods or electrodes and procedures in welding.

For oxyacetylene welding the following analysis range of gas welding rods is recommended:

Medium Carbon	0.20 to 0.40% C 0.45 to 0.85% Mn 0.45 to 0.80% Cr 0.90 to 1.60% Ni
High Carbon	0.67 to 0.80% C 0.97 to 1.15% Mn
Chrome-Vanadium	0.20 to 0.40% C 0.85 to 1.15% Mn 0.90 to 1.25% Cr 0.10 to 0.30% V

With the above, by using a welding flame with a slight excess of acetylene, a small carbon loss will occur. Manganese loss will vary as much as 30 to 40 percent.

For arc welding the following analysis range of electrodes is recommended:

Shielded arc or bare electrodes	0.32 to 0.42% C 0.90 to 1.20% Mn
Shielded arc, bare or dipped coated electrodes	0.85 to 1.10% C 0.30 to 0.60% C
Cast iron electrode	3.0 to 3.75% T. C. 2.75 to 3.50% Si

With the above, carbon loss will vary from 0.04 to 0.10 percent and will be higher on bare electrodes than on the shielded arc. The manganese loss will run as high as 30 to 40 percent.

In arc welding it is generally desirable to preheat the part to be built up, or repaired, in the vicinity of the weld, to at least 500 F. to reduce the hardness in the deposited metal, and thus prevent checking in flame hardening.

The expanse and form of the surface

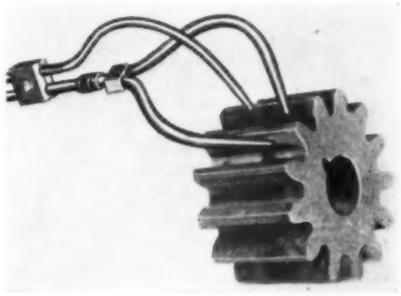


Fig. 18—*A standard two-flame tip bent pincher is shaped to heat small gear teeth along their faces. The quench tube (above and center) plays the quench stream over the tooth, behind the flames*

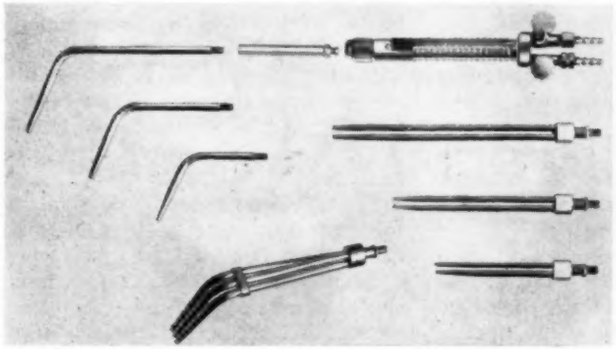


Fig. 17—*Ordinary welding or heating torch outfits consisting of a hand torch, a mixer and single, two and three-flame tips may be employed for simple flame hardening. Separate quench apparatus is used*

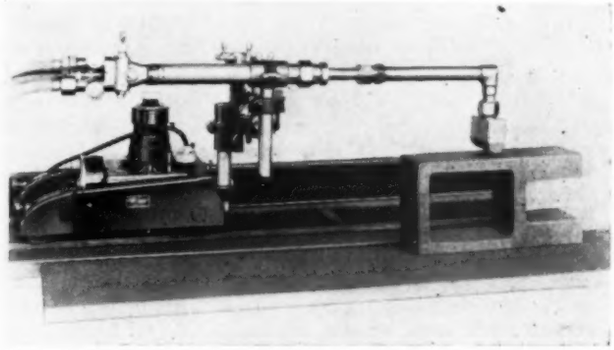


Fig. 19—*A water-cooled torch outfit is mounted on a vertical and horizontal adjustment mechanism and carried along path of the work by a radiagraph or other travelling machine*

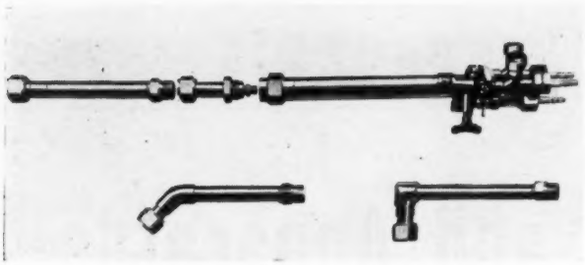


Fig. 20—*Another water-cooled torch outfit consists of a torch, mixer and straight, 45-deg. and 90-deg. angle extensions, all water cooled.* **Fig. 21**—***(Center)***—*Integral heating and quenching tips for water-cooled torches are employed on circular and flat work*

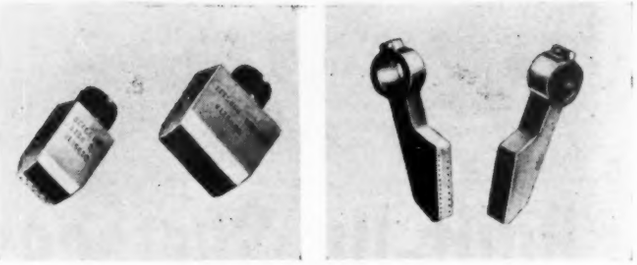


Fig. 23—***(Right)***—*These integral heating and quenching tips are designed especially for hardening gear teeth. They may also be employed for simultaneously flame hardening two opposite sides of a relative thin section. The tip unit is mounted on a traveling machine*

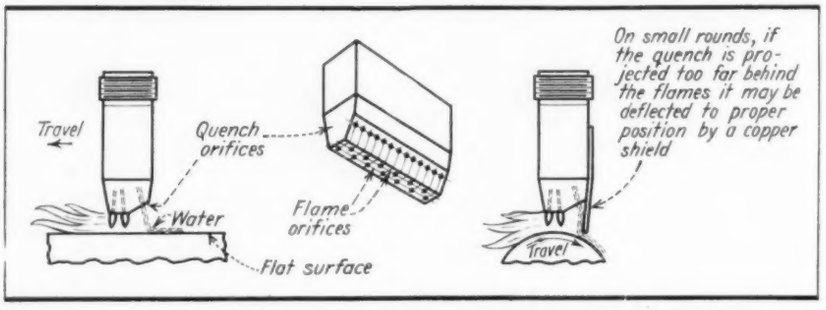

Travel
Quench orifices
Water
Flame orifices
Flat surface
On small rounds, if the quench is projected too far behind the flames it may be deflected to proper position by a copper shield
Travel

Fig. 22—*A diagram of an integral heating and quenching tip shows the relation of flame and quench jets to each other and to work being flame hardened. Sometimes water-cooled tips without quench orifices are used*

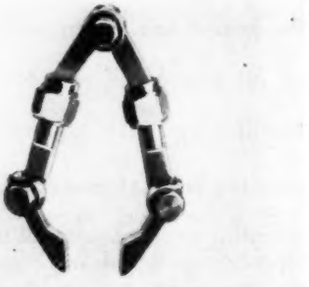


Fig. 24—*This assembly for gear-hardening tips permits adjustment of tip spacing to suit work*

to be hardened determine the choice of apparatus.

Simple flat surfaces of limited area may be manually flame hardened with ordinary welding or heating torches and tips as illustrated in Fig. 17. Such outfits consist of torch, oxyacetylene gas mixer and the tips, available in one, two, three or more flames. Separate quench apparatus may be improvised or the part dropped into a quenching tank. When such apparatus is employed for small gear teeth, the two-flame tip is bent pincher shape as indicated in Fig. 18, and an improvised water quench of ordinary copper tubing is made to suit.

Extended strips of surface are mechanically flame hardened by mounting a water-cooled torch on a radiograph, as shown in Fig. 19, or other travelling machine and moving the water-cooled and water-quenching tips over the work, or by mounting the torch in a fixed position and moving the work under the torch.

The water-cooled torch outfit, see Fig. 20, consists of a completely water-jacketed torch with oxygen, acetylene and water passages, each with individual control valve and an additional gas control cock for shutting off both oxygen and acetylene simultaneously. The oxyacetylene mixer and the straight, 45-deg. and 90-deg. angle extensions are likewise fully water jacketed as these parts must remain an extended period in the heat zone.

Standard water-cooled integral heating and quenching tips are available in widths of ½ to 4 in. as illustrated in Fig. 21. As these tips are constantly within the flame zone, an adequate water-cooling sytsem is provided. In this integral heating and quenching type, the cooling water circulates in cooling passages within the tip and is then expelled through properly spaced and positioned quench jets to the work immediately behind the flames as shown in Fig. 22. Where other types of quenches are required, either for quenching after spinning application or for tank quenching, then water-cooled tips without quenching systems are available. The cooling water is either expelled out of the side or top of the tip through a tube which carries it beyond the work area.

For mechanically hardening gear teeth 3 D.P. and larger, standard gear hardening yokes with water-cooled integral heating and quenching tips are employed for hardening both sides of a tooth simultaneously, as illustrated in Figs. 23 and 24. The yoke assembly is affixed to the end of a straight extension from a water-cooled torch, and the entire torch and tip unit mounted on a radiograph, as shown in Fig. 25, or other travelling machine. Such machines are equipped with slow speed motors and means for vertical and horizontal adjustment. The gear-hardening yoke permits adjustment for exact positioning of the tips in relation to the pitch diameter of the gear.

Bevel gears, because of the changing cross section of each tooth require apparatus with still greater flexibility. Such is illustrated in Fig. 26. The spreader yoke an dspreader arms allow for indexing the tip spacing to conform with the increasing thickness of the bevel gear tooth. The assembly is mounted on a standard heating torch.

Machines for production flame hardening of gears are manufactured by the Gleason Works, Farrel-Birmingham, the Fellows Gear Shaper Company, and others.

Fig. 27 shows a standard design tip for flame hardening an 8-in. internal diameter. It is made in four segments and is provided with a water-quenching ring immediately behind the flame blocks. Each segment is separately supplied with gases through a single torch and independently operated to provide a perfectly balanced flame around the entire circumference of the part being flame hardened. Such apparatus is used

on internal diameters ranging from 4 to 24 in.

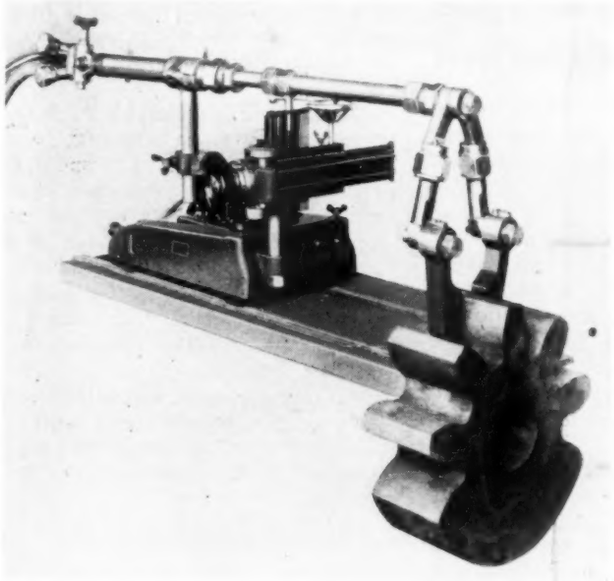
For flame hardening external rounds a tip assembly like that illustrated in Figs. 28 and 29 is employed. Five segments are shown in the two segments for a 2-in. diameter round to fourteen segments on a 24-in. diameter round. Each segment is supplied gases through its own torch.

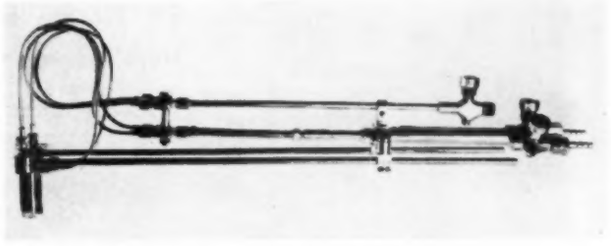
It is frequently advisable that the operation of the torch be conducted from a remote station. In such cases torches without shut-off valves may be used and the operation carried on at a panel station, apart from but in view of the work. Valve control blocks similar to those shown in Fig. 30 may be mounted on a panel in any number required to operate as many torches as necessary. A single lever will quickly shut off both oxygen and acetylene. For multiple torch operation, a master lever or cam arrangement can be built to shut off any number of torches either simultaneously or in a desired sequence as the job requires.

Because of the volume of gases employed in a brief period when carrying on production flame hardening, it is advisable that both oxygen and acetylene cylinders be manifolded so that a reasonably large volume of gas is always available, and the necessity of frequent changing of cylinders and regulators is eliminated. In the case of the flame hardening a continuous area on a large part, no interruption of the flame application is permissible as it would result in a softened zone at such point. In these instances, manifolding is compulsory.

Both oxygen and acetylene can be supplied from portable manifolds when it is necessary to move from one location to another in yard or shop. It is preferable whenever possible, to set aside one area for the majority of the flame hardening operations. This is generally in the heat-treating department in large plants. Then stationary six to thirty cylinder oxygen manifolds and stationary four- to twelve-cylinder acetylene manifolds may be installed.

The next installment of this series will be found in an early number.





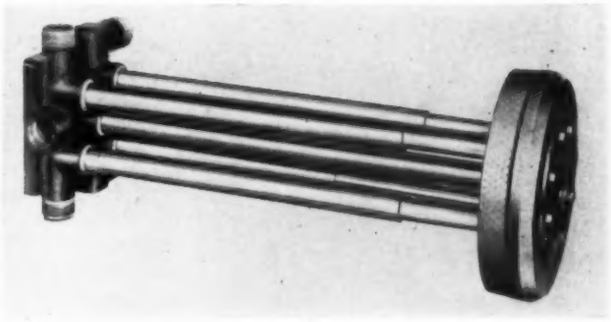


Fig. 25—*A gear-hardening yoke assembly with a water-cooled torch mounted on a vertical and horizontal adjustment mechanism is carried along face of gear teeth by a radiagraph or other travelling machine.* **Fig. 26**—***(Top, right)***—*A flexible indexing mechanism of spreader yoke and arms is used for flame hardening the faces of bevel gear teeth.* **Fig. 27**—***(Lower)***—*This internal diameter flame-hardening tip assembly may be mounted on any machine tool providing horizontal or vertical travel as required*

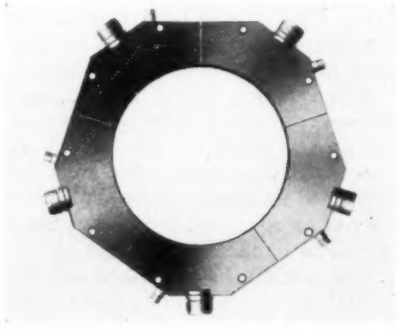


Fig. 28—*This external diameter flame-hardening tip assembly may be mounted on any machine tool providing horizontal or vertical travel to suit the job*

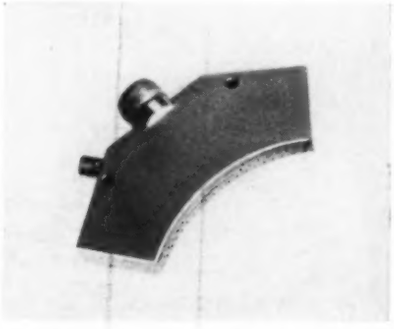


Fig. 29—*The single segment tip shown here is part of an external flame-hardening tip assembly like that shown in Fig. 28. Separate torches supply gas to each unit*

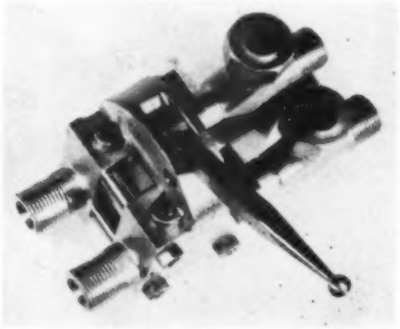


Fig. 30—*Valve control blocks for remote shut-off control of gases come in single or double units, as shown, and may be mounted in multiples on a remote control panel*

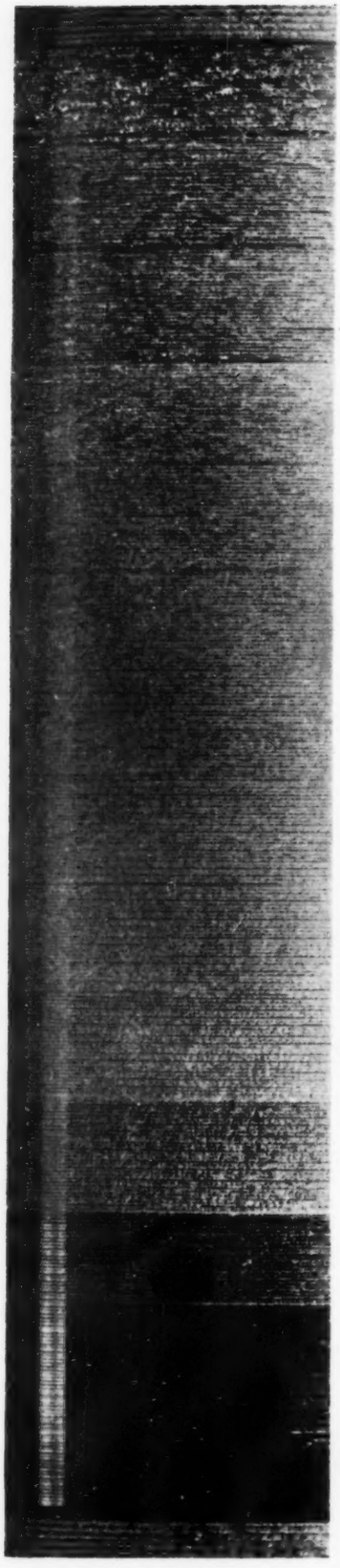


Fig. 1—Each of 14 cuts *made at the speeds indicated in ft. per min. shows a distinctly different appearance, ranging from an extremely rough to a glazed surface.*

Critical Speeds For Carbides

BY R. H. McCORMICK, VASCOLOY-RAMET CORPORATION

Best results are obtained with carbide-tipped tools when the correct cutting speed is used. Here's a way to find that speed

A SIMPLE cutting test, which can be conducted in almost any shop in ten minutes' time or less, will determine the correct cutting speed for cemented carbide tools on practically any material.

The test consists of a series of cuts at various speeds, the correct speed being indicated by the appearance or finish of the cut and the condition of the tool.

In the test which illustrates this article, an annealed log of SAE 3150 steel, 6½ in. in diameter was used. Fourteen cuts, each ½ in. long and 0.032 in. deep were taken with a standard Vascoloy-Ramet Grade *EM*, Style 11 tool, using a feed of 0.016 in. per rev. No coolant was used, and no changes were made during the test, except to adjust the speeds as follows:

Cut Number	*Surface Speed Ft. Per Min.*
1	42
2	56
3	74
4	93
5	118
6	144
7	178
8	198
9	235
10	308
11	374
12	525
13	684
14	886

The general appearance of the log after this series of cuts is shown in Fig. 1. It will be seen that the first four cuts are rough in appearance, and the last three are glazed.

The roughness of the cuts made at too slow speeds is caused by a "built-up" edge on the tool. This gives the appearance of the work being torn rather than cut, but what actually happens is that the built-up accumulation of metal is released periodically from the edge of the tool, and is pressed into the work. This is shown clearly in Fig. 2.

As the speed is increased, the built-up edge phenomenon disappears, and the cut becomes clean. The speed at which the cut becomes clean is commonly called the "critical," or minimum speed at which the material should be machined at the depth of cut and with the particular make and grade of carbide tool being tested. The sixth cut, Fig. 3, at 144 surface feet per minute would be called the critical cut. This is the slowest speed at which the work shows a clean cut appearance without evidence of tearing or accumulated edge debris being pressed into the work as it rotates.

Speed Selected After Test

The actual cutting speed to be used in regular production runs usually is somewhat higher than the critical. This is best determined by actual experience based upon a study of the amount of tool wear and the number of pieces machined per tool grind. In the illustrated test, either the ninth or tenth cut, at 235 and 308 surface feet per minute respectively, Fig. 4, could be accepted as the optimum cutting speed from a standpoint of production and tool economy.

When cutting speeds are too high, the work assumes a shiny or glazed appearance, as shown in Figs. 1 and 5. At these speeds, sufficient edge wear has developed to cause a slight land below the cutting edge, and the work is being burnished by the face of the tool.

This test can be applied to any material that can be machined with carbide tools. It should be made on a machine capable of being operated at a number of speeds, starting at a speed known to be too slow, and continuing to the speed where glazing occurs or the tool edge fails. The depth of cut and feed

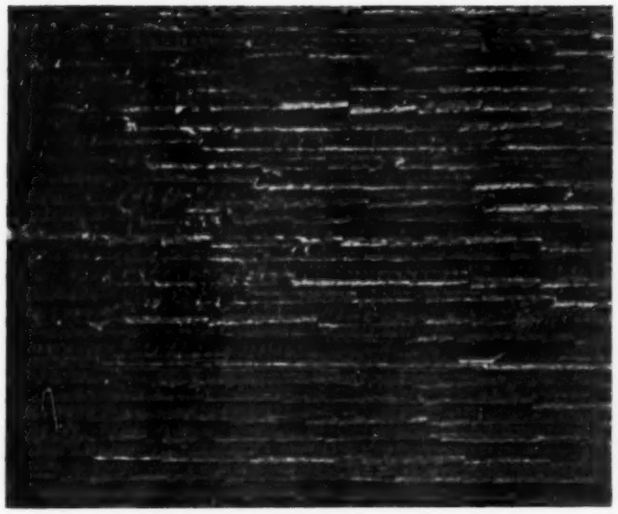


Fig. 2—A magnified section *of the first, second and third cuts shows the "torn" appearance resulting from too slow speeds*

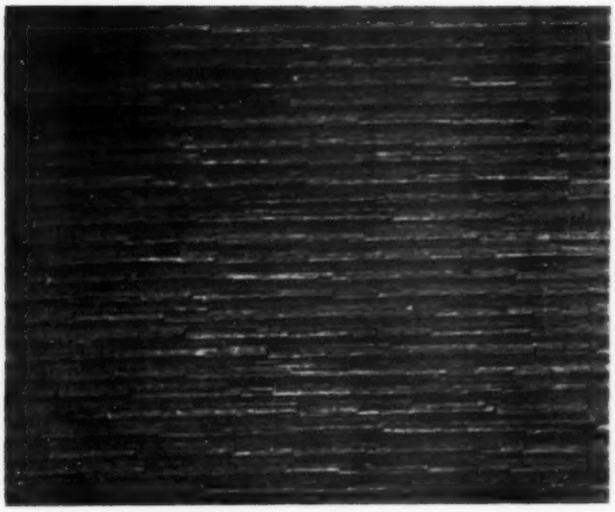


Fig. 3—The bottom section *of this modified view is the sixth cut, at 144 ft. per min. The "torn" effect has disappeared and the cut is clean*

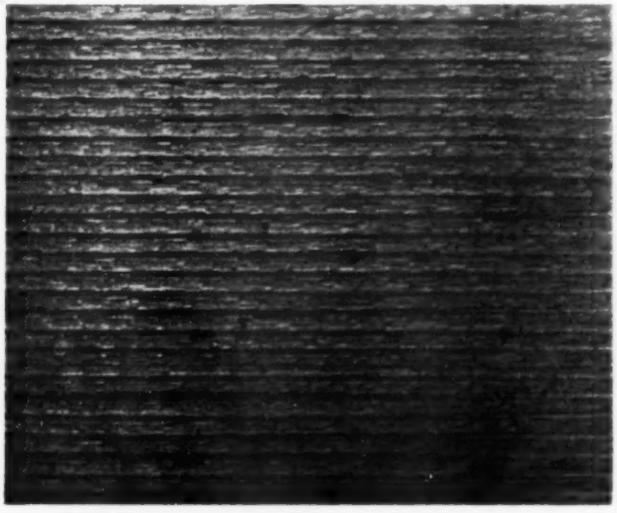


Fig. 4—The ninth and tenth cuts *are clean, yet show no evidence of glazing as a result of too high speed, either could be selected as the optimum speed*

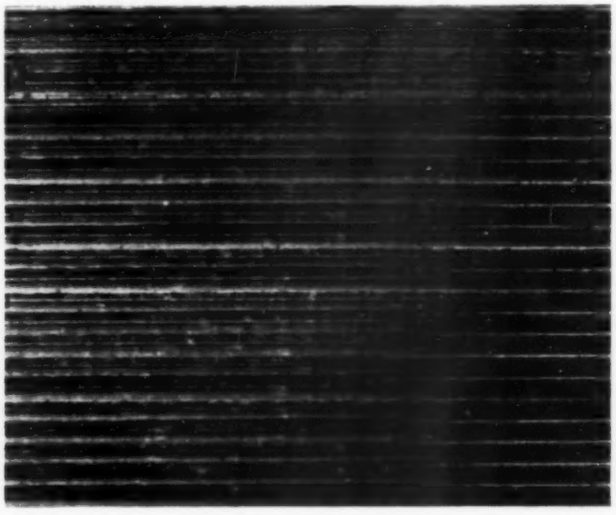


Fig. 5—The last three cuts *were at speeds too high for economical tool life. The tool edge is worn sufficiently to form a land which rubs the work*

should be the same as those intended for actual production runs, and if a coolant is to be used in production, it should be used in the test.

Under most conditions, it is not necessary to remove the tool for examination during the test, nor is it necessary or desirable to grind the tool at any time while the test is in progress.

Second Cut Taken at Critical Speed

After completing the test and having found the critical speed, it is advisable to sharpen the tool, then make another cut at the observed critical or minimum speed. After taking this cut, the tool should be removed and examined. If there is no built-up edge, the true critical speed has been established. If there is a built-up edge, as in Fig. 6, another cut should be taken at increased speed. The speed to be used for actual machining may then be selected from one of the speeds between the critical and the speed at which indications of glazing appear.

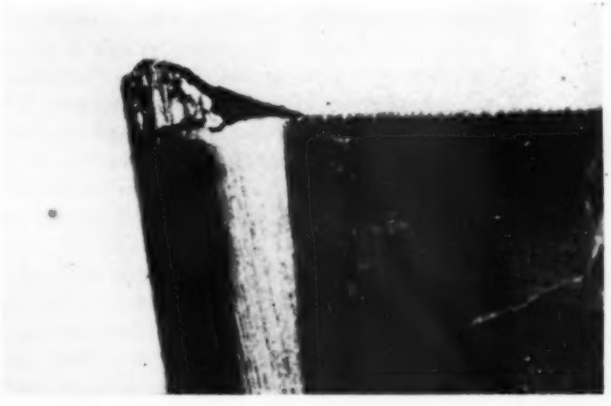


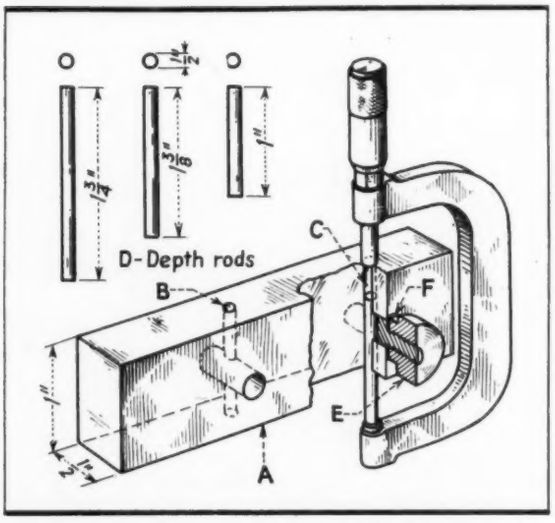
Fig. 6—The "built-up" edge, *resulting from cutting at too slow speeds, is an accumulation of the chip welding to the tool. At increased speeds, this does not occur*

IDEAS FROM PRACTICAL MEN

Simple Depth Gage for Training Schools

BY MARTIN H. BALL

The illustrated depth gage was made for a training school machine shop where students are taking intensive courses to fit themselves as machine operators. The requirements for this gage were that it



This depth gage, designed for and built by machine shop trainees, is used in conjunction with a standard micrometer

be an accurate tool, and that it could be made by some of the most competent trainees.

A tool with micrometer or vernier adjustment seemed out of the question. However, those who were to use it were capable of reading a micrometer, and it was thought best to make a gage that could be used in connection with a standard micrometer.

The base block *A* was made exactly 1 in. high by grinding and lapping both top and bottom surfaces after hardening. Holes *B* and *C* for the depth rods were made, one near the end and the other near the center of the base to better adapt the tool to varying conditions. The depth rods *D* were made in lengths varying $\frac{3}{8}$ in. commencing at one inch and running upwards.

In use a rod must be selected that will not project above the top surface of the base *A*. The ends of these rods were finished on their ends by lapping—this was done by holding them in a block having a flat base and a true vertical hole which is a free fit on the rods. The rods need not be exact in length as only one end of them ever contacts the work.

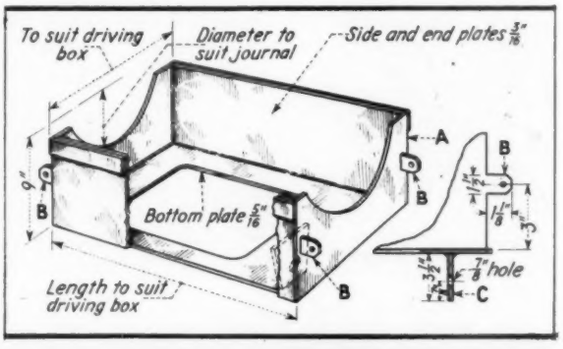
The clamp *E* has a spring washer *F* that holds the rod by light friction while adjustments are being made, and allows permanent tightening to be done without disturbing the setting.

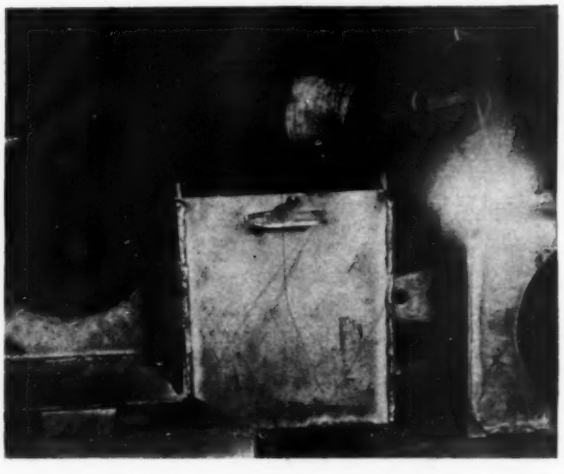
When the tool is set, an accurate measurement can be made by placing a standard micrometer with its screw over the $\frac{1}{8}$-in. hole in the top of the base and its anvil under the lower end of the depth rod. The micrometer then reads 1 in. more than the depth of the actual measurement. Thus a reading of 1.250 in. indicates a depth measurement of 0.250 in.

An All-Welded Locomotive Grease Cellar

BY ARTHUR HAVENS

Listed near the top in the long list of fabricated items that are rapidly replacing huge and heavy locomotive castings is the all-welded grease cellar. Usually the cast-iron cellar is badly cracked or broken when it is removed from the driving box. Whether this is due to carelessness on the part of the work-





This all-welded grease cellar is made from $\frac{5}{16}$ and $\frac{3}{16}$-in. plate, and is being used by one eastern railroad to replace cast-iron units

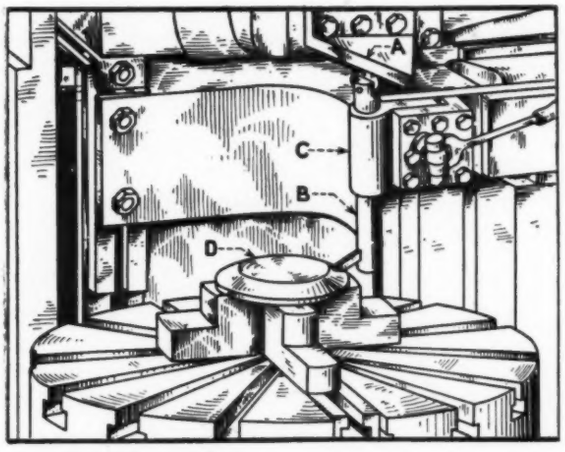
man or whether the cellar becomes broken in service is more or less a mystery; however, they *are* broken and a suitable replacement is needed. The all-welded steel grease cellar seems to survive the use and abuse of high-speed freight and passenger service.

The method of constructing this cellar is shown in the drawing. The sides, ends and bottom pieces are either sheared or flame cut after which they are set up on the bench and welded together. The end plates are slotted to slip over lugs *B* left on the sides. Small S-hooks are made and inserted in the holes in the lugs *B* after the front piece is in place. The lug *C* on the bottom of the cellar has a $\frac{7}{8}$-in. hole in it so that it will slide readily over the stud in the front of the driving box; this holds the cellar securely in place.

Form Turning on a Vertical Turret Lathe

BY FRED H. COLVIN

The machine shop of the Mohawk Carpet Company builds many looms for their own use, some of them to weave carpet up to 18 ft. wide. These looms, as well as some of their subcontracts on



Blanks for bevel gears are machined in this vertical turret lathe. The tool bar fitted with a roller rides in the tool holder, and is actuated by moving against a templet bolted to the crossrail

defense orders, require many bevel gears. The quantity required taxed the capacity of the lathes available for turning the gear blanks.

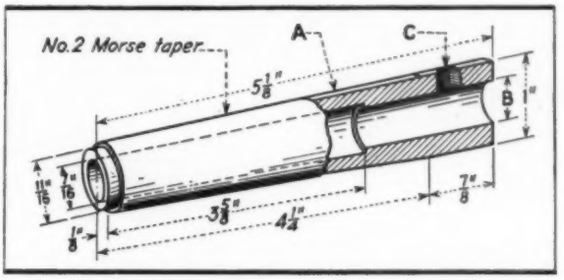
To speed production of the blanks, several vertical turret lathes were pressed into service. The blanks are turned to the proper angle using a former templet of the rail of the vertical turret lathe, shown in the drawing. The former *A* is bolted to the rail and forces the tool bar *B* to follow the angle set by the former above it. The bar is held in holder *C* by a compression spring. The gear blank *D* is held in the chuck in the usual manner, and the former makes it unnecessary to measure the angle or to use any combination of cross and down feeds to get the shape desired on the gear blank before the teeth are cut.

Center Collet for Turning Cold-Rolled Pins

BY C. F. FITZ

We had to turn several thousand $\frac{3}{8}$-in. diameter cold-rolled pins in a lathe which had a four-jaw independent chuck that would not hold $\frac{3}{8}$-in. diameter stock. We were able to take care of the job by making the center collet *A* shown in the drawing.

It is similar to a regular lathe center with the



This center-type collet was used for turning several thousand ⅜ in. cold-rolled pins

exception that it does not have the usual 60-deg. point on the one end. Hole *B* was drilled and reamed to take care of the stock at hand. The other end was drilled to a diameter of $\frac{7}{16}$ in. and to a depth of $3\frac{5}{8}$ in. to provide clearance. Hole *C* was drilled and tapped to receive a $\frac{1}{4}$-in. oval-point headless setscrew, which was used to hold the stock in place while it was being turned.

This center collet worked so well that we made a complete set to take care of stock from $\frac{1}{16}$ to $\frac{3}{4}$ in.

Making a 25-foot Turret Ring in a Small Shop

BY FRANK C. HUDSON

Some kinds of big defense work can be handled in comparatively small shops when versatile mechanics with ideas are on the job. The job in question was the cutting of the teeth in a 25-foot ring gear for turning a battleship turret, with no gear cutter capacity of this size available.

The ring was turned and bored on a large boring mill found in the neighborhood. Cutting the teeth *A* was the real problem. These were laid out with a templet on the side of the rim as accurately as possible. Then the bulk of the metal between the teeth was drilled out as shown at *B* to reduce the work of the form cutter that shaped the teeth.

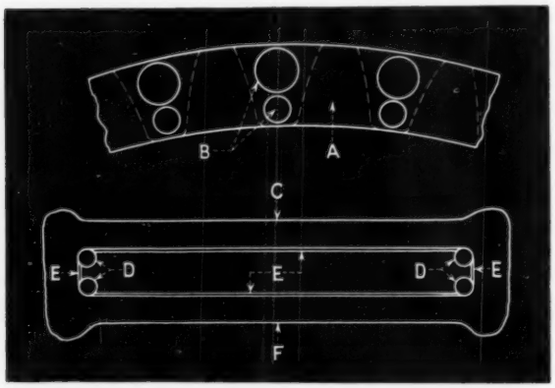
Actual cutting of the teeth was done on a Dill slotter, which has the ram mounted in a slide that can be moved horizontally. This movement made it easily possible to feed the cutter into the work to any desired amount.

Before the final cut was taken, except on the first tooth, the spacing was checked by putting pins between the teeth and measuring across them. In this way the second tooth was checked for chordal distance *from the first pin*. Careful checking made it

possible to maintain sufficient accuracy from tooth to tooth.

Suitable means had to be provided for supporting the large ring both for drilling and for cutting the teeth with a formed tool in the ram of the slotter. Roughing and finishing tools were used and careful attention paid so that correct contours could be preserved.

Specifications called for the ring to be forged



A 25-ft. diameter gear blank was made by cutting the center from a billet and forging it to shape. Teeth were cut on a slotter after drilling out most of the metal between the teeth

from one billet, without welding. So the ring was made from a solid billet *C*. It was upset to some extent at each end, then holes *D* were drilled and four cuts *E* taken with a milling cutter. With the center *F* removed, the slot was opened until a ring was formed, and the cross-section hammered to an approximately uniform thickness. The ring was then ready for turning and boring.

Shank Extensions Welded to Drills

BY CHARLES C. LYNDE

Some time ago, while in charge of a pipe-line station far from sources of tool supply, a job came up in which 12-in. holes had to be drilled through steel pump castings to permit through bolts being used for an emergency repair. The holes were first put through with an electric hand drill, using $\frac{5}{16}$-in. bits for the pilot holes. Since the available bits of this size were less than 5 in. long, it was necessary to weld extensions to them to drill the full depth of hole.

We first tried welding as suggested by Arthur Havens (*AM*—Vol. 85, page 857), but had considerable trouble due to breakage either in the weld, or immediately adjacent thereto. The shank of the high-speed drill used showed large grain size and indicated overheating.

To avoid the overheating which seemed to be inescapable when using the usual pipe-line welding torch, brazing was tried instead of welding. The brazing was accomplished at a lower temperature than could be used with welding, and as a result the steel of the bit and extension stem were not modified or overheated.

After changing over from welding to brazing, no further troubles were encountered with breakage through the virgin metal on either side of the junction, and the few instances where the joining was twisted off, due to excessive pressure or the sudden striking of porous or hard spots in the pump casting, the brazed joint served as a shear point and yielded without damage to the bit. This last was an item of considerable value on this particular job, because the available stock of $\frac{5}{16}$-in. bits soon became used up as breakage reduced the number on hand.

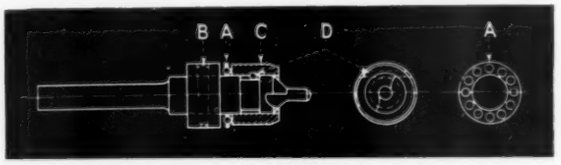
Since this initial experience with brazing, we have relied upon it as a means of attaching bits to extension stems. The brazed junction, of course, is ground to size as would be a welded connection and, being softer than steel, provides a convenient point for locating any slight bends or deformations necessary to align the bit point with that portion of the shank held in the jaw chuck of the electric drill.

A Countersink Designed for Depth Control

BY PETER L. BUDWITZ

In an effort to maintain accuracy in the depth of countersunk holes on machine parts, the countersink shown in the accompanying illustration was designed. The tool incorporates a ball bearing thrust collar *A* between a fixed collar *B* and floating sleeve *C*.

The countersink proper is made of high-speed steel with the conventional tooth form. Fixed collar *B* is made of hardened drill rod, and is attached to the countersink by means of a taper pin. Floating collar *C* is also made of hardened drill rod and contains a retainer pin *D* which prevents the sleeve from dropping away from the countersink since the pin engages the recess machined in the periphery of the counter-



A ball bearing thrust collar between the fixed collar and floating sleeve of this countersink controls the depth of the countersunk hole and prevents marking the work

sink. The ball retainer is made of yellow brass having a series of holes drilled in it to receive the ball bearings.

In operation, as the countersink nears the desired depth, the floating sleeve contacts the work, thus exerting pressure against the fixed collar. The thrust bearing absorbing the friction causes the sleeve to stop revolving with the countersink, thereby preventing any excessive marking of the work piece.

Armament

SECTION OF AMERICAN MACHINIST

The oxyacetylene cut-off machine, breaking press and furnace for heating billets are grouped together to conserve space. For higher production requirements, a mechanized pusher or rotary-hearth furnace would be employed

Forging 155-mm. Shell Bodies

BY FREDERICK G. SCHRANZ

General Manager, Baldwin-Southwark Division
The Baldwin Locomotive Company

THIRTEEN PIECES rejected as unusable out of a production lot of more than 5,000 forgings for 155-mm. high explosive shell is a record seldom attained in most shell forging shops. Such a record recently was set by a pilot forging group in the Eddystone plant under normal operating conditions. These forgings were made from square billets with rounded corners of standard WD X1340 steel.

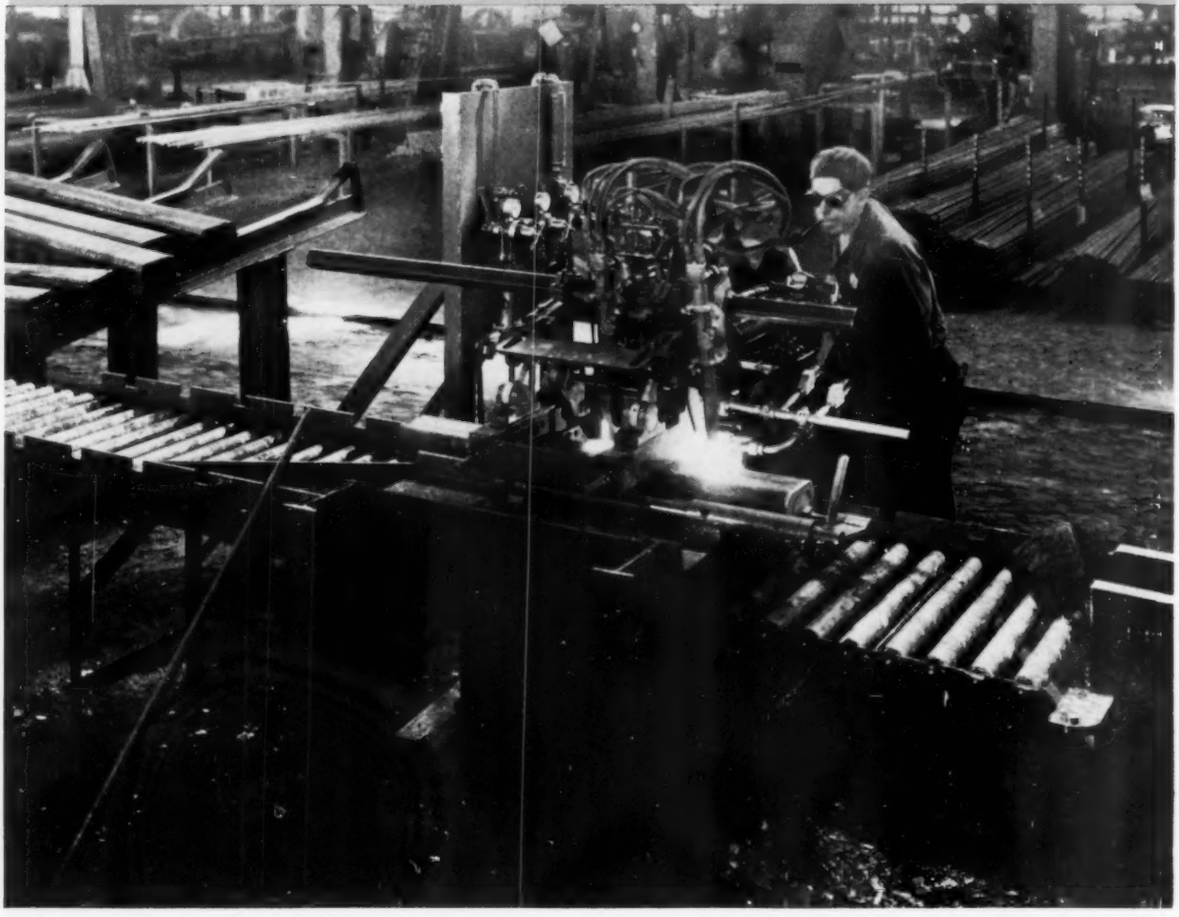
Mill-length bars of forging stock, measuring approximately 6½ in. across flats and 8 in. across corners, and about 20 ft. long, are stored in the yard, according to heat number, until needed by the forging group. When a supply of bars is needed, they are transferred from the outside storage yard to a stock pile inside the building on railroad cars. In the

forge shop, these bars are removed from the "bank" stock pile to a rack near the cut-off machine by magnet crane.

From the feed rack, the bars are moved by hand to a roller conveyor that carries them one at a time in front of a Linde two-head oxyacetylene cut-off machine positioned beside the conveyor so that the torches feed across the conveyor. This cutting machine is equipped with stops which position the bar so that a double billet 24¾ in. long is cut off one end by the left-hand torch in an automatic cycle. During the same cycle the right-hand torch burns a nick across one flat side of the bar half-way between the end and the cut taken by the first torch. This nick at the mid-point provides a starting point for the breaking operation which follows. One man is required to operate the gas-cutting machine and the operator of the nearby hydraulic press spends a portion of his time feeding bars to the cut-off machine and moving cut billet lengths to the press along the roller conveyor line.

Double billets are broken into two equal pieces to form single billets in a 300-ton vertical hydraulic press using dies constructed as shown in an accompanying sketch. These heat-treated dies are made from 40 to 60 point carbon steel and are finished all over. The roller conveyor line leading from the cut-off machine to the press extends onto the press platen beside the cracking dies. Mounted perpendicular to this conveyor on the press platen is an auxiliary horizontal hydraulic cylinder direct connected to the controls of the press. When the press ram reaches its high point on the return stroke this cylinder is actuated to push a double billet from the conveyor

Double-length billets are cut from mill-length bars and nicked at the midpoint in this Linde automatic unit. One man operates the machine while a second man spends part of his time helping move stock to and from the machine

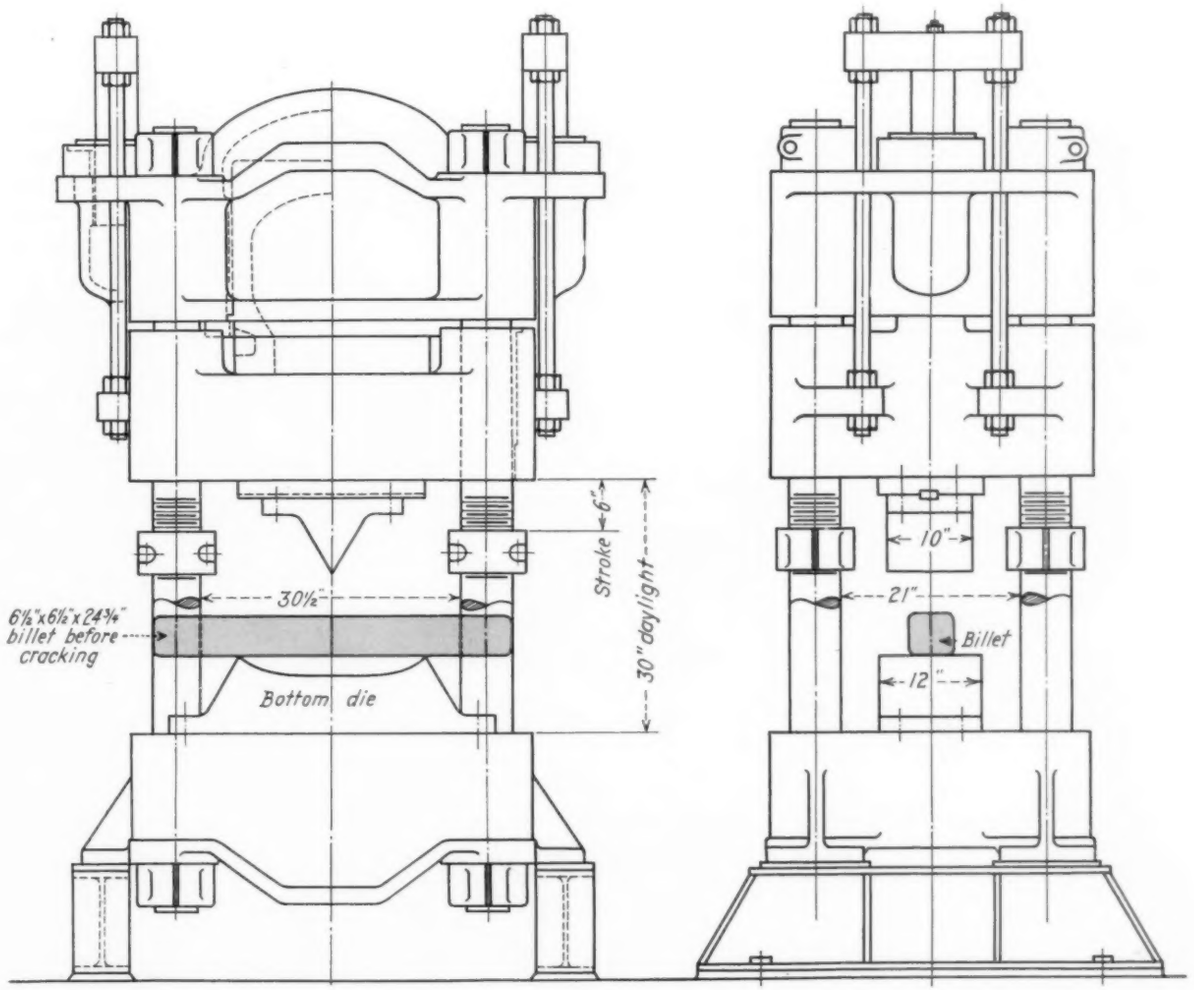


on to the lower die. In doing so, the ram pushes the two halves of the previously broken billet off the lower die on to another roller conveyor line leading to an inspection bench and a power-driven slat conveyor.

On the inspection bench the broken end of each billet is inspected for piping, seams and other defects before being sent along to the heating furnace. The "nick-and-break" method of separating billets from the bar stock has an additional advantage over making all of the cuts with a gas torch. If both ends of the billet are cut with torches, a slag deposit is left on both ends. Thus, it is possible that some of this slag will be carried into the cavity of the finished forging by the piercing punch and the drawing mandrel, and so produce defects that cannot be remedied.

One operator and three helpers feed billets from the slat-type conveyor into the reverberatory-type oil-fired furnace, using long push bars that are cooled occasionally in a nearby tank of water. In order to reduce weight, these bars are made up with forged handles and hooks at either end and with a center section made of heavy-duty pipe. As this is a pilot-line set-up, a hand fed furnace was selected. For installations handling heavier tonnages, mechanical pusher-type furnaces or rotary-hearth furnaces are recommended. The present arrangement requires approximately six man-minutes per billet heated. The billets are brought to a temperature of 2,150 F. and allowed to soak at that temperature until heated all the way through. Automatic temperature control is provided so that billets withdrawn at the other end of the furnace will be of uniform temperature.

A group of three men, consisting of one operator and two helpers, move heated billets from the dis-



The vertical hydraulic press used for cracking double billets into two equal pieces has a 24-in. main ram and two 5-in. pull-back rams that operate under constant pressure. The press is designed for a working pressure of 1,500 lb. per sq. in. Ram speed is such that the press will make about 7½ strokes per minute

charge end of the furnace, pass them through the hydraulic descaler, and feed them into the large Baldwin-Omes piercing machine nearby. While one crew performs these operations, a relief crew is resting. At frequent intervals, the crews change places. This operation requires approximately 7.56 man-minutes with the two crews on duty.

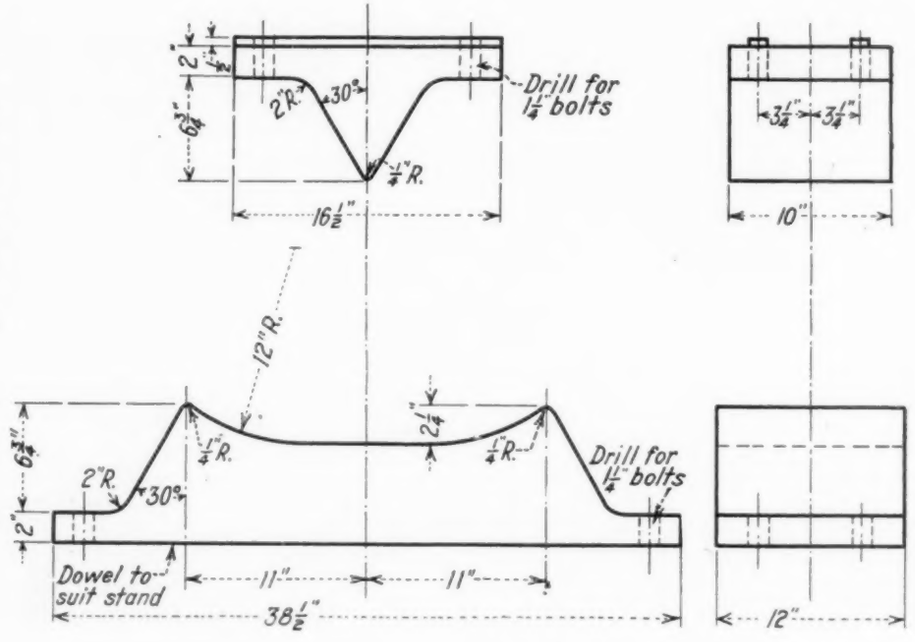
Each billet is pulled out of the furnace with a long bar, then pushed endwise down a V-type roller conveyor through the hydraulic descaler. This unit directs several fine streams of high-pressure water onto the surfaces of the billet, loosening and forcing away scale formed in the furnace. In addition, one of the helpers stands beside the conveyor with a hand scraper to remove any particles of scale remaining on the billet before it is fed into the piercing machine.

Square Billets Require Less Power

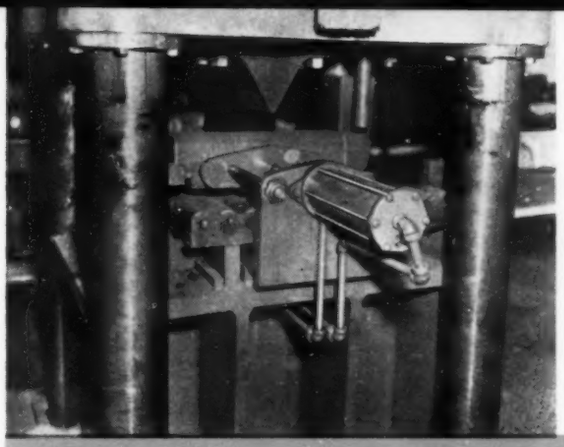
After descaling, the billet is pushed onto a carriage in the center of the piercing machine, then this carriage is moved forward by hand to position the billet in the opened split die, where it rests on a lower surface of the fixed die half. As soon as the billet is in position and the slide returned, the operator of the machine steps on a treadle valve to close the die. The slide carrying the movable half of the die also carries a base die against which the billet is forced as the piercing punch moves forward. It has been found that a ram speed of approximately 14 in. per sec. produces best results in this machine, as well as in the smaller sizes. Driven by a 150-hp. motor through suitable driving gears and a heavy flywheel, forgings for 155-mm. shell can be pierced at a rate of approximately 50 to 60 per hr. in one of these machines. It has been found that the square billet adopted requires less power, as it is expanded into a round cup as the piercing punch moves forward, while a round billet would have to be extruded over the punch. Further, less wear is experienced on the piercing punch and in the split dies when using square billets.

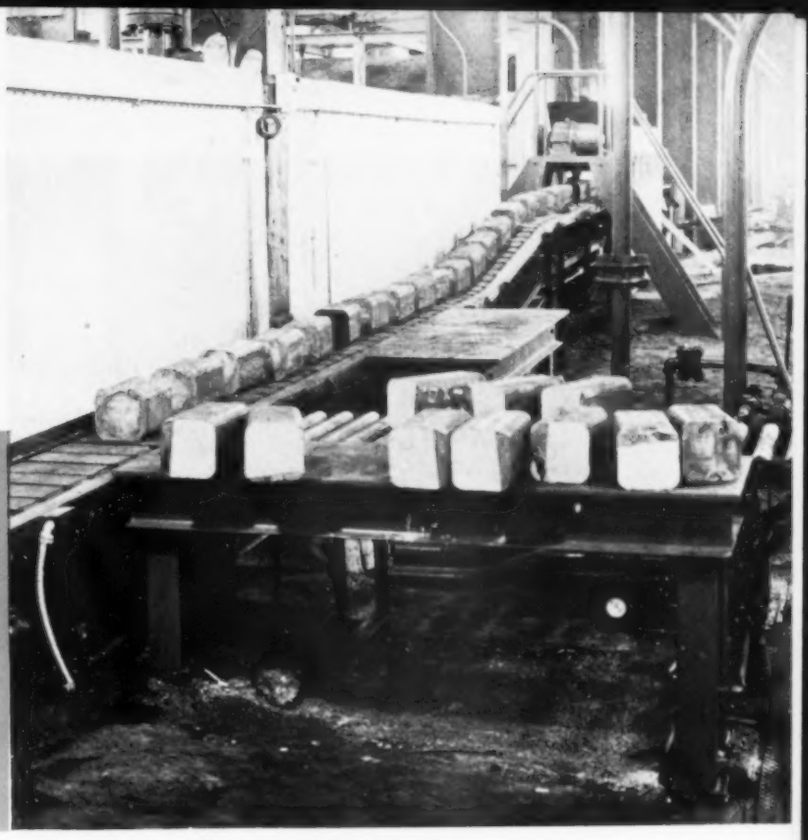
It has been found that best results are obtained when worn punches and dies are replaced promptly, and are redressed before replacement in the machine. It is better to spend a little extra time and make good forgings than to speed up the operation and make forgings that won't pass the inspector. A defect in the surface of the punch almost always will produce scored cavities. Further, if the punch is scored on one side, it will be drawn over to that side while passing into the billet because of the added resistance. It is almost impossible to correct eccentric forgings produced by a damaged punch. Experience with this pilot forging line has shown that a piercing punch will have an effective life of approximately 2,000 forgings when removed and redressed frequently. Likewise, the piercing dies will last for approximately 15,000 forgings when kept in good condition. Both the piercing punch and the split dies are arranged for cooling with cold water so as to increase their life.

When the piercing punch has been withdrawn from the forging on the return stroke of the machine, an ejector in the bottom of the base die pushes the



These tools are used in the hydraulic press for cracking double billets previously notched by an oxyacetylene torch. Dies are of substantial proportions to stand up under the pressure needed to crack the work piece

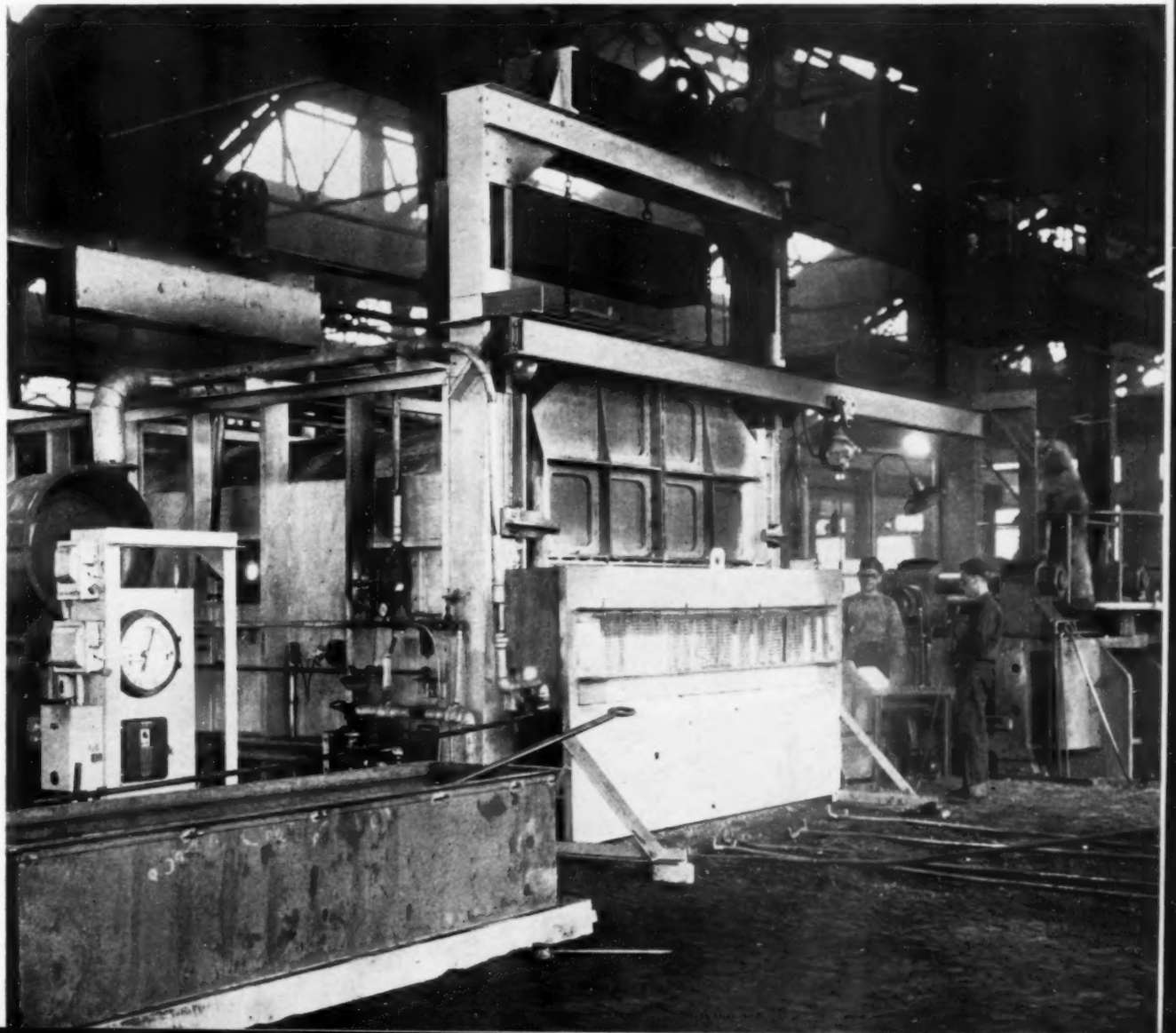




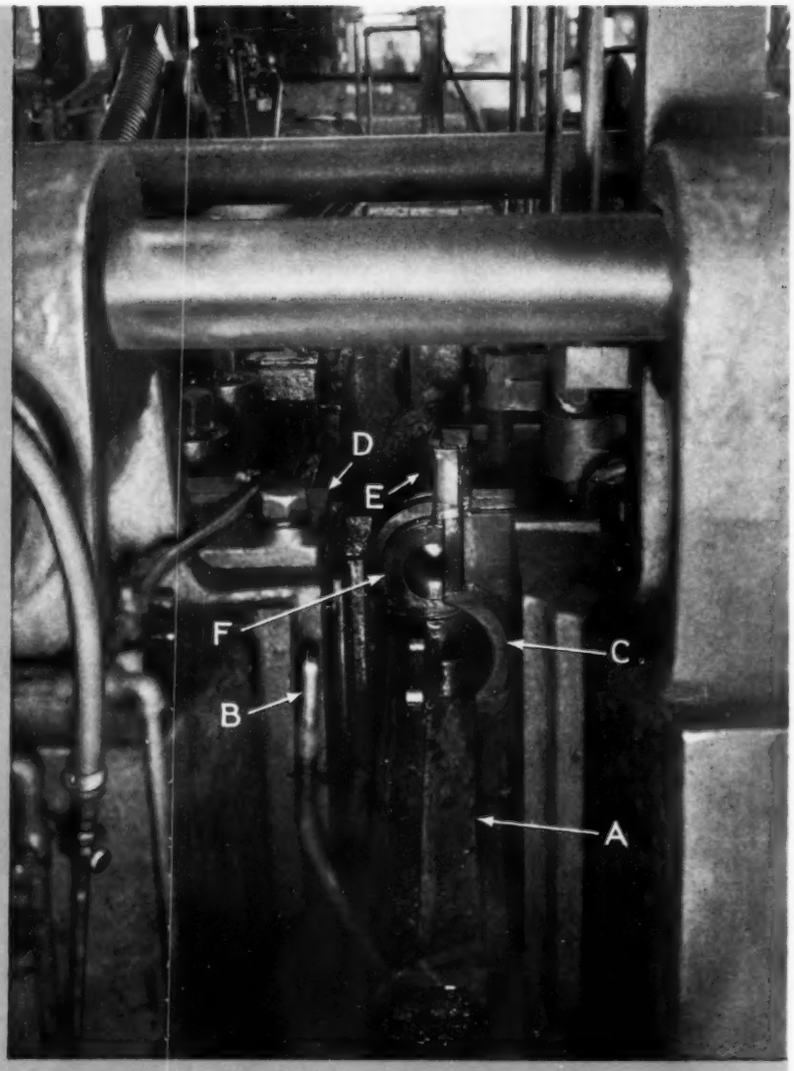
An auxiliary hydraulic cylinder on the press platen automatically moves a double billet onto the lower die when the press ram is returned to its top position

The broken end of each billet is checked carefully for piping, seams and other defects before delivery to the heating furnace by the power-driven slat conveyor shown at the right. Speed of this conveyor is 30.21 ft. per minute

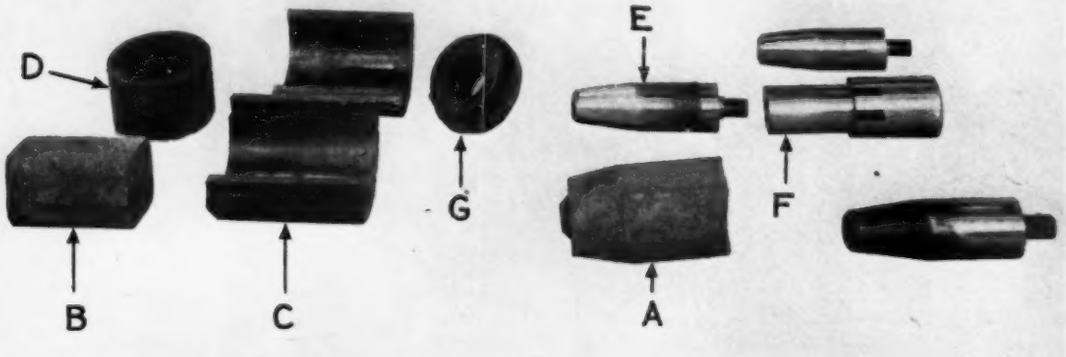
A crew of three men remove billets from the furnace, pass them through an hydraulic descaler and operate the Baldwin-Omes piercing machine



Dies in the PM 75-DP20 Baldwin-Omes billet piercing machine have been designed to handle square billets. When all scale has been removed, the hot billet is pushed onto the carriage *A*, which then is moved into the machine with handle *B* to position the billet in the fixed die half *C*. Next, carriage *A* is withdrawn and the slide *D*, carrying the other half of the split die, is moved transversely to the closed position to locate and grip the billet. A base die also is mounted on slide *D*. This die takes the thrust of the piercing punch *E* and forms the base of the forging. Ring *F* is mounted in front of the split die to provide support for the punch at the start of the piercing operation



In the Baldwin-Omes piercing machine the forging *A* is formed from the square-section billet *B* in one stroke. The billet is gripped between the halves of the split die *C* and the base end of the forging is formed in the pot die *D*. Piercing punch *E* is held in adapter *F* on the ram of the machine and bushing *G* guides the punch to produce a concentric forging



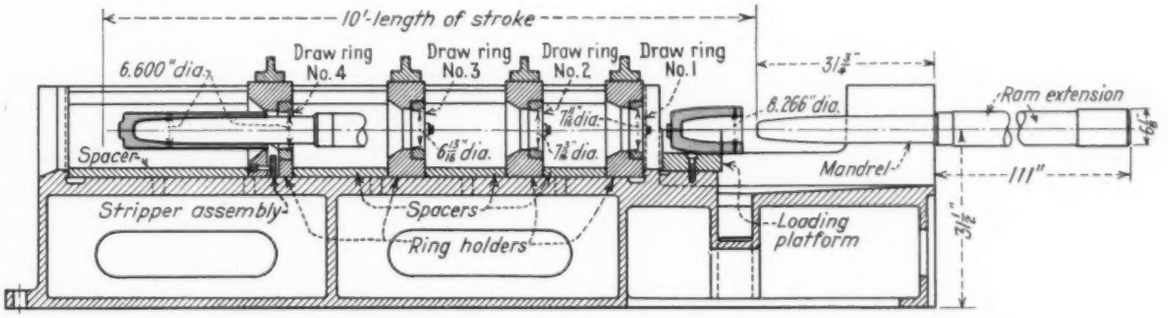
forging out of that die and it drops down a chute onto a drag-link elevator conveyor whose lower end is directly under the dies. This conveyor travels at approximately 55 ft. per min. to raise the pierced forgings to the drawing machine.

For shell forgings smaller than 155-mm. the Baldwin-Omes piercing machine is combined with the drawing machine. In order to increase the capacity of these combination machines, two sets of piercing mandrels, die liners and drawing mandrels are provided so that each piercing mandrel and drawing mandrel can be used in rotation. This both reduces wear and gives the tools time to cool, and so prolongs the life of the tools. However, operation of the units made for larger shell is slow enough to permit adequate cooling of the tools, and the separate piercing and drawing machines have only one set of tools each.

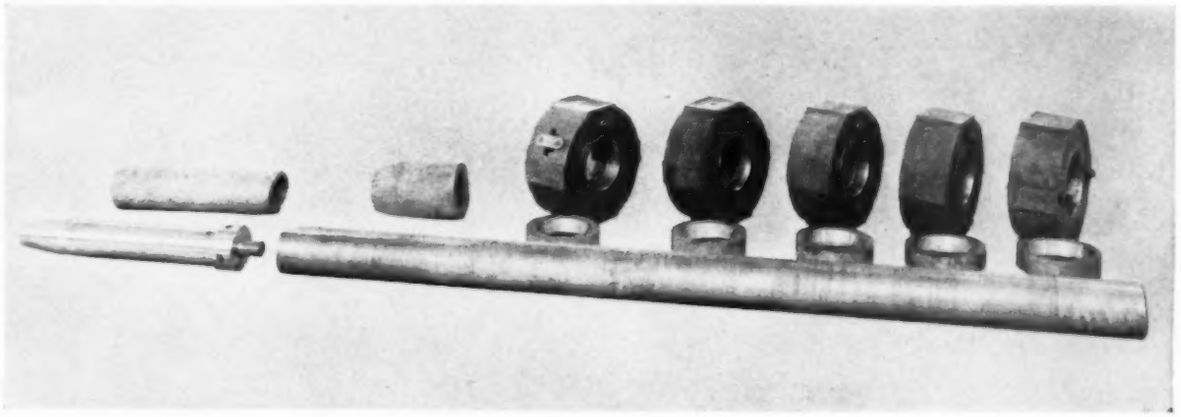
The largest piercing unit in the Baldwin-Omes line is employed in this pilot forging group. It has capacity for piercing forgings for up to 7-in. diameter shell and is rated at 750 tons. Maximum pressing stroke of this unit is 14 in. Like the smaller units, this piercing machine has the advantage that it readily can be converted into a standard universal forging machine when the emergency is over and no more shells are to be forged.

The large Baldwin-Omes screw-type drawing machine is rated at 200 tons and has a maximum drawing stroke of 118 in. It is driven by a 200-hp. motor. With a ram speed of approximately 20 in. per sec., this unit will draw approximately 60 shell forgings per hour of the 155-mm. size. Along the draw bench are spaced five solid draw rings, the last of which is equipped with three radially arranged latch-type strippers against which the forging is drawn on the return stroke of the ram to strip it from the mandrel. The general arrangement of these draw rings and strippers is indicated in an accompanying sketch. One operator and four helpers are required to perform all of the necessary work at this drawing machine.

The drawing mandrel is arranged for internal cooling with water, and water is piped to each of the



The draw rings are spaced along the bed of the machine so that the forging is passed all the way through one ring before it enters the next ring. The latch-type strippers are mounted in the last ring



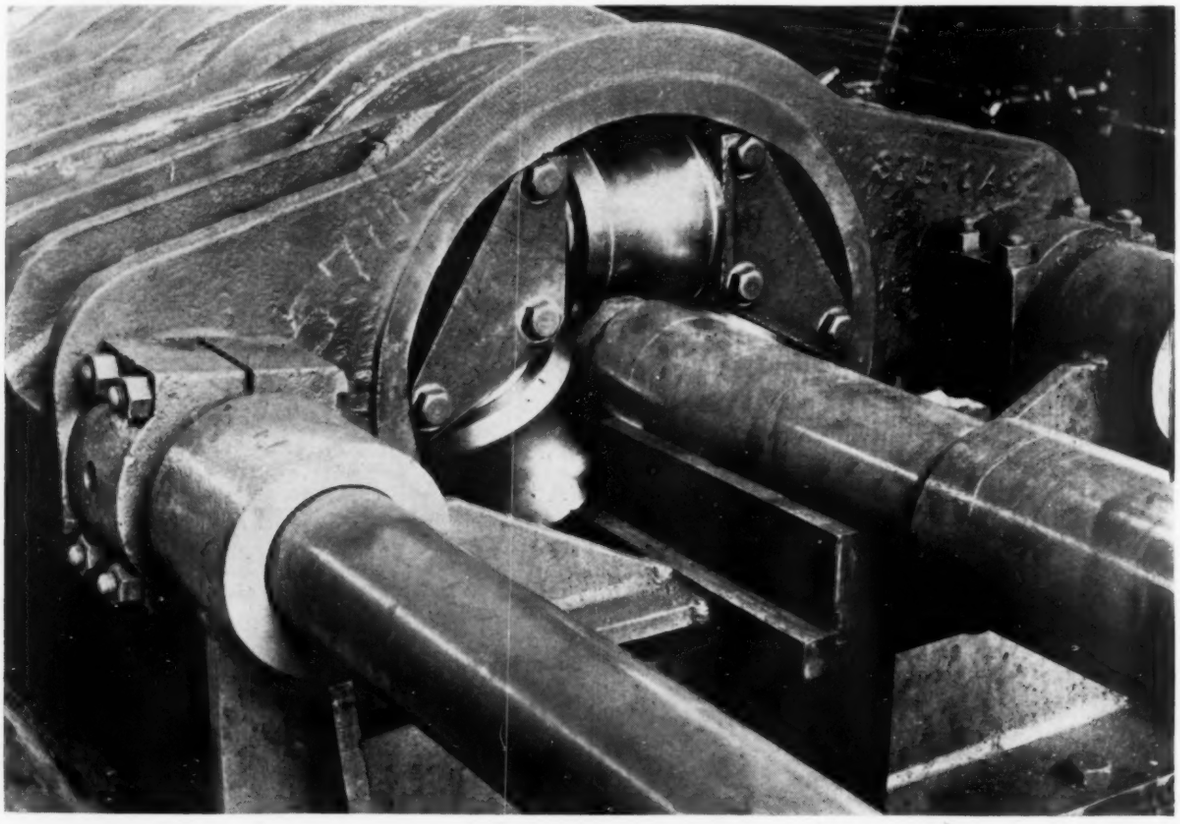
A set-up having five draw rings are substituted for the four-ring arrangement shown in our accompanying sketch in order to lessen the reduction in each step and so increase tool life. Drawing mandrel and draw rings are arranged for cooling with water

draw rings for cooling by spray. These sprays also help to cool the mandrel as it passes through the rings on the return stroke. Experience has shown that if the mandrels and rings are removed and redressed at frequent intervals to prevent scoring, a mandrel has a useful life of from 3,000 to 5,000 shell forgings while a ring can be used for from 10,000 to 15,000 forgings. Spacing of the draw rings along the bed of the machine ordinarily is such as to permit the forging to have passed within about 1-in. of being through one ring before it is entered into the next in line.

At the start of each shift a dummy billet is heated to 2,150 F. and placed in the die liners of the piercing machine and the drawing machine so as to bring the piercing punch and die liners up to temperature before any actual forging is attempted. This has been a major factor in the reduction of rejects in this forging group.

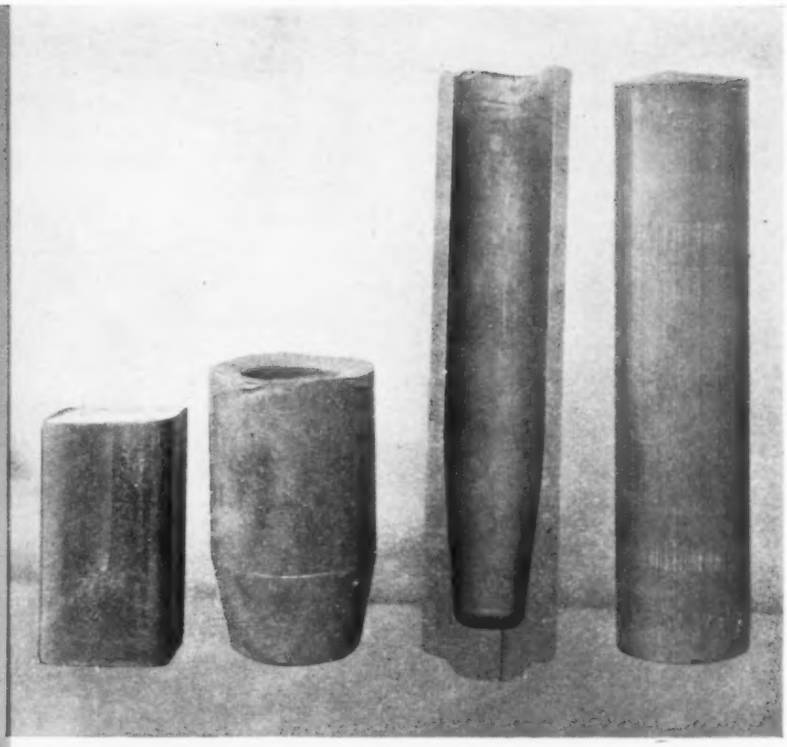
Hydraulic shell drawing presses, generally of the horizontal type, also have found wide acceptance. Usually, these horizontal presses have a multiple arrangement of drawing ring die heads like that used in the Baldwin-Omes drawing machine. It is of interest to mention here the development of the roller type drawing die. A set-up using such die heads is shown in an accompanying photograph. In this arrangement, each die head carries three rollers; the contact point of the rollers being shifted 60 deg. on every other head. In this arrangement, the rollers are revolved by pushing the shell through the die heads. The number of heads on horizontal roller type drawing presses ranges from three for 3-in. shell up to nine heads for the larger shell. Roller type die heads are advantageous as they produce a smoother finish in the cavity of the shell and roll the material over the drawing mandrel instead of forcing it through the solid rings. The roller action improves the quality of the steel in the shell.

Drawn shell forgings are dropped onto a power-driven slat-type conveyor when stripped from the drawing mandrel. This conveyor delivers the forgings to a checking station where an occasional forging is tested for concentricity and all forgings are stamped on the base and with a die carried on the ram of an hydraulic cylinder. From this position the forgings are rolled on rails through a 20-ft. cooling tunnel, where the temperature of the forgings is reduced

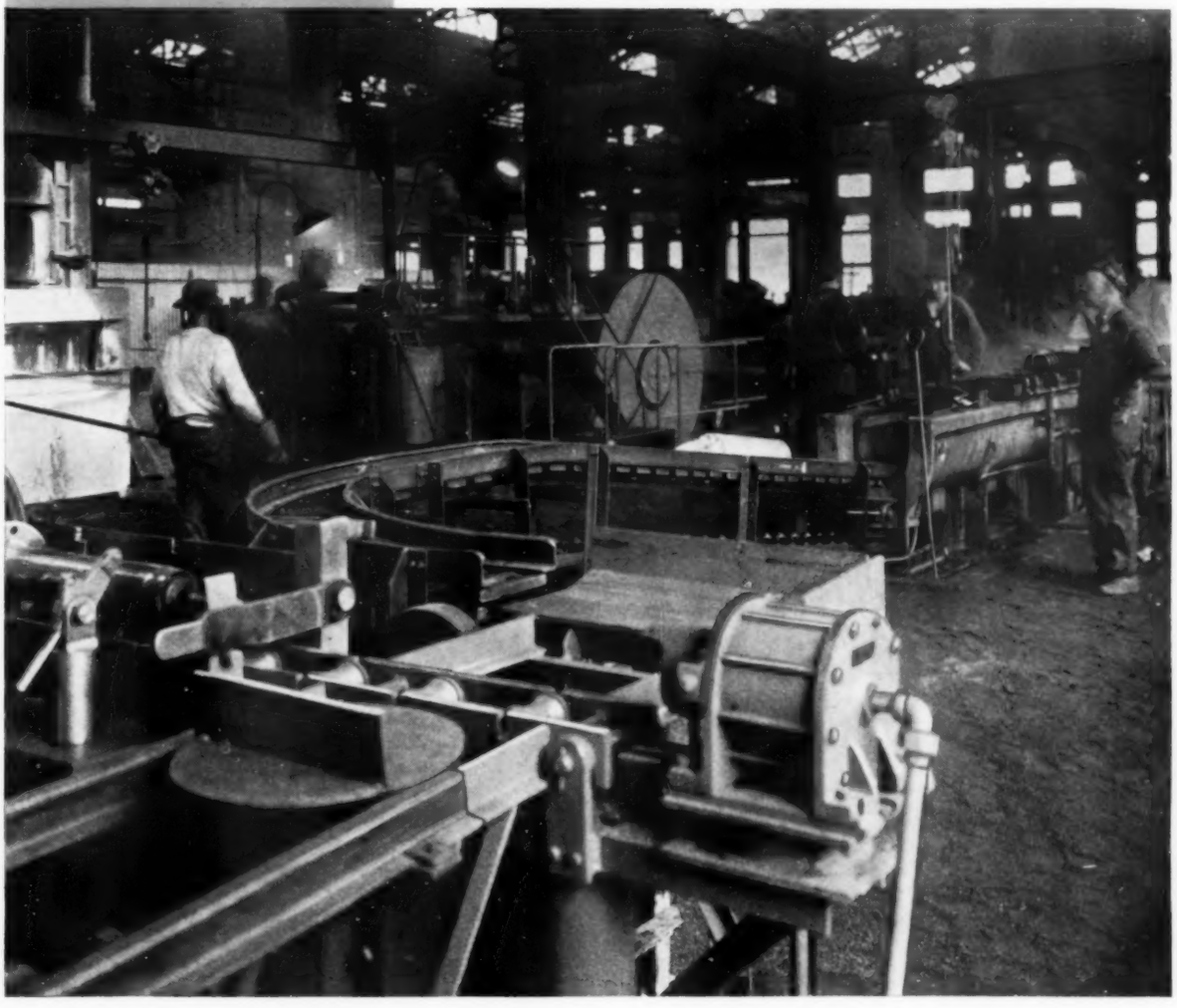


Recently developed roller-type die heads have produced over 150,000 shell with one set of rollers. A ring die is used at the end of the bench for sizing

Square-section billets are pierced and drawn to form 155-mm. shell forgings with little difficulty when mandrels and dies are kept in good condition. Frequent tool dressing, while expensive, is cheaper than scrapped forgings made with damaged tools



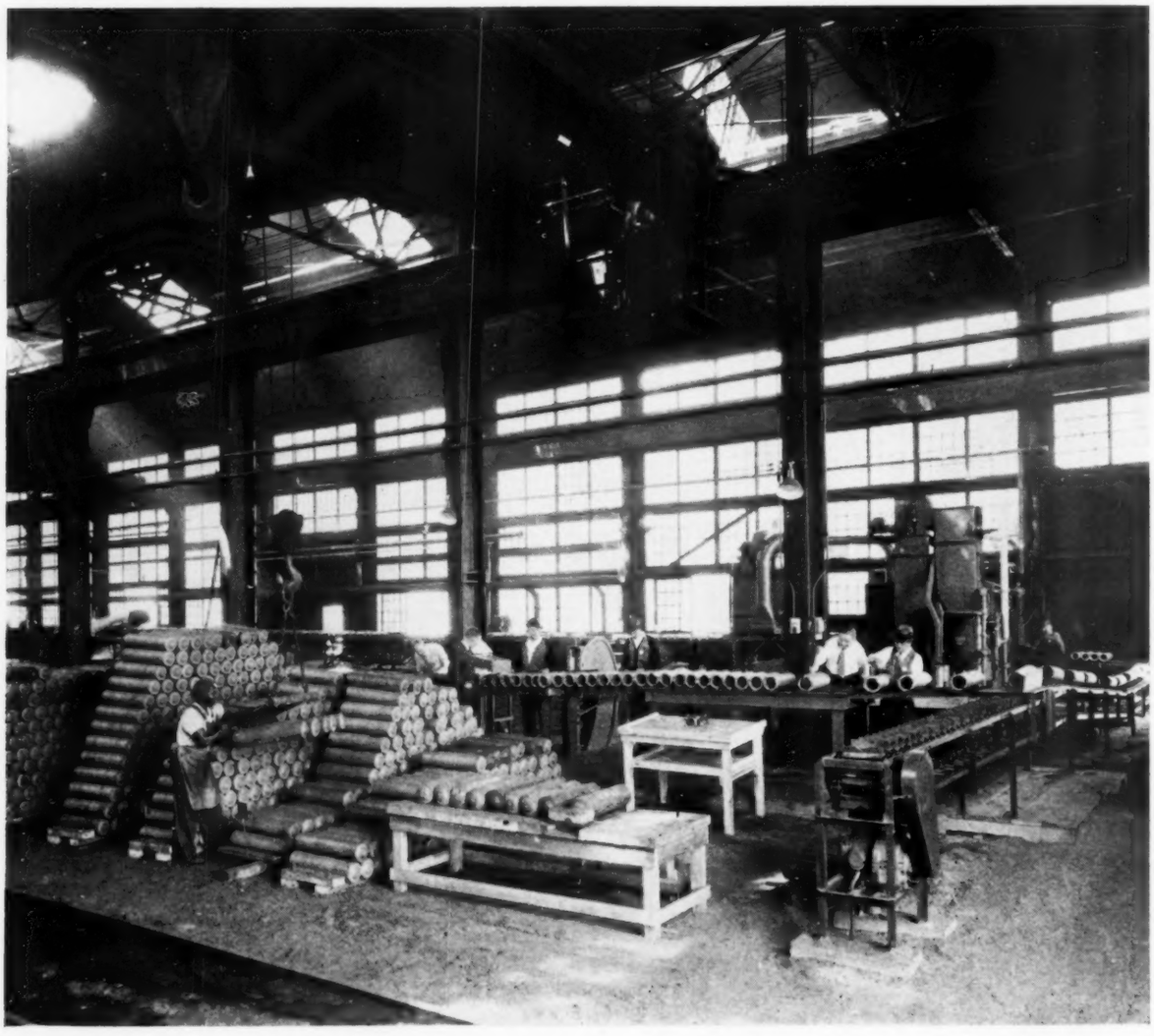
Forgings stripped from the drawing mandrel are raised by a power-driven slat conveyor to this station. Here each shell is stamped with identifying numbers and symbols, and an occasional forging is checked for concentricity of cavity



gradually. In order that the forgings may cool further before cleaning the cavities, they are rolled down about 50-ft. long rails after they leave the cooling tunnel before they reach the cleaning machine. On the discharge end of the shotblasting machine, there is a power-driven, slat-type conveyor driven at 30 ft. per min. which carries the cleaned shell to the final inspection station where they automatically are transferred to a bench.

Shop and government inspectors check each forging on a long inspection bench fed automatically from the slat conveyor. Accepted shell are lifted five at a time by over-head crane from the inspection bench to a cooling area nearby. Then, when a carload of shell forgings has accumulated, they are lifted from this area to railroad cars for shipment to machining contractors.

Considerable savings can be made in the weight of each forging, no matter whose forging equipment is used, if the shell forger has also a contract for machining his own forgings and uses forging equipment that will produce concentric, straight forgings. Then he can reduce the outside diameter, thickness of base and length of the rough forgings to a point which will give him just enough allowance for finish machining. Thus, he can save many pounds of steel by using lighter billets. However, if the shell forger is producing rough forgings only for the Government, these forgings must meet specifications as to weight and size and larger billets are necessary.



Shotblasted shell forgings, brought to this inspection bench by power-driven slat conveyor, automatically are transferred to the rails on which they are inspected. Handling of accepted forgings to the storage area is speeded by using a five-pronged grab

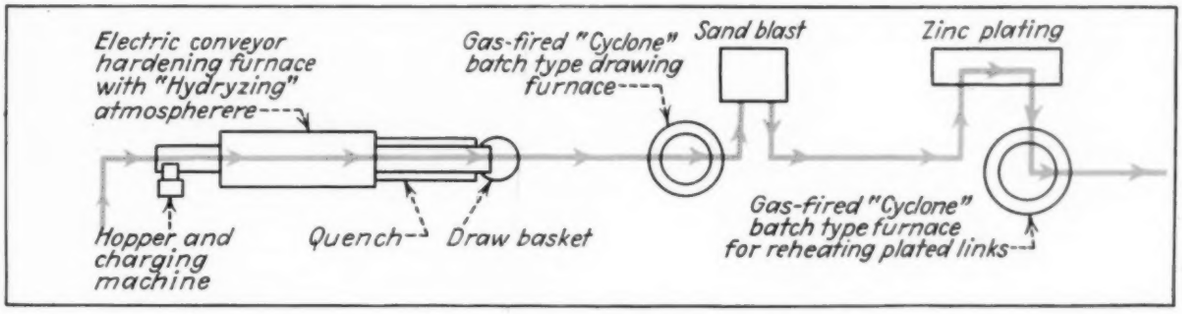
The furnace at the left rear is a Lindberg electric conveyor hardening furnace with "Hydryzing" atmosphere. The quench tank and flight conveyor are shown at the front center and the "Cyclone" gas-fired draw furnaces to the right. Overhead hoists handle the baskets. Note the use of exhaust blowers on draw furnaces to carry smoke (caused by vaporizing of quenching oil) to the outside atmosphere

Cartridge Link Heat-Treating

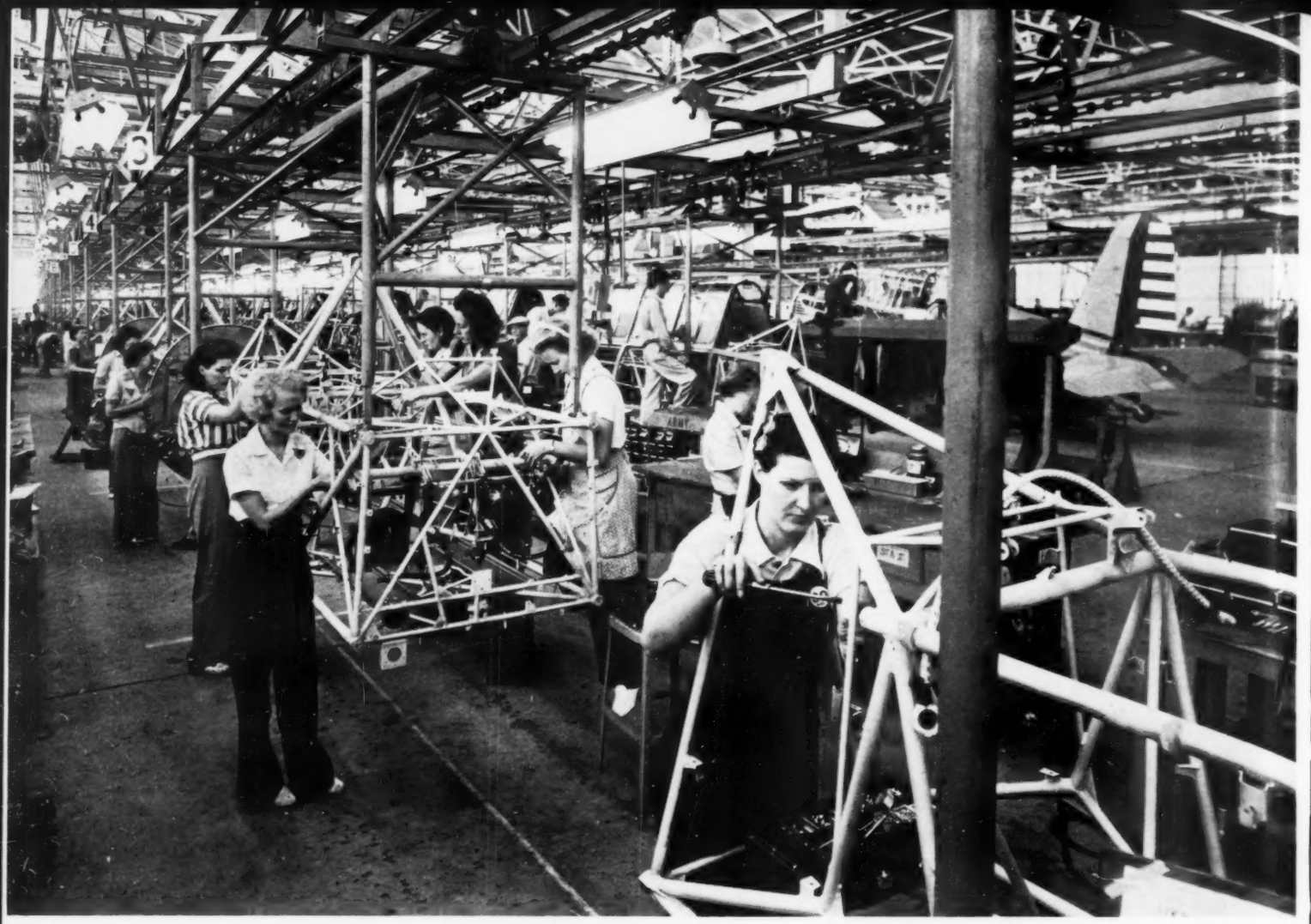
ONE OF THE NEWEST installations for cartridge link manufacture has just been completed at the Metallic Link Division of The Barnard Aviation Equipment Company.

From the press, the links pass directly to a continuous controlled atmosphere furnace for the hardening operation. The links are carried through this "Hydryzing" hardening furnace on a heat resistant belt, and are automatically quenched from 1,575 F. by dropping into the oil quench tank where they come to rest on a conveyor belt extending up from the bottom of the tank. They are then carried to a basket, ready for tempering. Production is 700 lb. per hour.

Three "Cyclone" vertical batch draw furnaces are shown, two being intended for reheating the links after zinc plating to prevent hydrogen embrittlement. If the substitution of other rust-proofing processes for zinc plating prove feasible, these two furnaces can be eliminated; only one furnace is required to handle the drawing of the links upon removal from the oil quench. Gas-fired furnaces make possible the drawing operation without intermediate washing to remove the quench oil. Links are cleaned in a Wheelabrator prior to plating.


Electric conveyor hardening furnace with "Hydryzing" atmospherere
Gas-fired "Cyclone" batch type drawing furnace
Sand blast
Zinc plating
Hopper and charging machine
Quench
Draw basket
Gas-fired "Cyclone" batch type furnace for reheating plated links

This arrangement of heat-treating equipment is used at Barnard Aviation for Cal. .30 and .50 cartridge belt links. The sandblast serves primarily to remove burrs and rough spots. Experiments are under way to conserve zinc by using other rust-proofing methods than zinc plating



Vultee has found that women workers require little pre-employment training, are quick to learn, and are especially adaptable to repetitive operations. They are used in almost every department, including the assembly line

Women at Work

BY R. A. LAWSON, WORKS MANAGER, VULTEE AIRCRAFT, INCORPORATED

Women are better than men for many jobs in aircraft plants because of their competitive spirit, finger dexterity and capacity for tedious work assignments

IT MAY BE a bitter pill for some old-timers to swallow, but it is true in these days of streamlined national defense programs that many a girl is a better man than her father ever was. Women have encroached on many male occupations in the past, and are now proving their worth throughout the aircraft industry.

Many of them are employed at the Vultee aircraft factory, including the machine shop. Not content with the burring and filing work on small aircraft parts, they have taken over a large share of the drill-press work, and two women have been advanced to milling machine operation. They are active too in other parts of the factory; in fact, everywhere except in the foundry, hammer shops, pattern shop and the center wing assembly department. Women have been put to work on welding, riveting, inspection, subassembly and final assembly, as well as in the paint shop, trim shop and on other types of work.

Vultee has been using women since last April, long before a mounting shortage of available man power induced the government to urge aircraft plants to put women to work wherever possible. Since April, Vultee has made a great deal of progress in the use of women workers. However, they have very definite limitations, and it would not be fair either to the women or the men to say the women can be used to good advantage everywhere in the aircraft factory. Realizing this, Vultee has made a continuing study of the proper application of women to our produc-

tion program and have done our best to place them in jobs where their special talents can be developed. Women cannot be used on heavy work, or where much stretching, reaching or lifting is required. They should never be expected to do much reaching up over their heads, or to work in awkward or unnatural positions, as they are not built for such jobs.

In England, under pressure of the war crisis, some aircraft plants have as high as 80 per cent women workers. We could probably match this figure if we had to, but we think that about 50 per cent women is the highest figure possible on average aircraft work without making substantial sacrifices of production efficiency. Women seem to work best at simple, repetitive operations. Fortunately, under our present mass-production program it is possible to break down our fabricating and assembly work into many simple operations which can be learned quickly by women. But much of the work must continue to be of a type requiring a high order of skill and experience. Furthermore, while we have a few women in sub-supervisory capacities, we think that the foreman in all cases must be a man. One reason for this is that women, at least under California law, cannot work more than eight hours in one day or 48 hours in any one week. But foremen must often work early and late to make sure that work is arranged for their crews. Also, the foremen must have experience and ability which would rarely, if ever, be found in a woman doing shop work. Finally, women are reluctant to take supervision from other women.

We did not start hiring women for shop work last April because of a shortage of man power, although we did anticipate that such a shortage might occur later. The main reasons for our move in this direction were twofold: Many women were demanding a greater part in the defense program; and we wanted to try to eliminate a number of shop bottlenecks through the use of women. Certain repetitive operations which at the same time required a high degree of finger dexterity were bogging down under our male crews. It was our hope, and time has proved it was well founded, that women could speed such work. The knitting needle tradition seems to make it possible for women to tackle tedious jobs and keep them moving at a rapid pace and without undue effort or fatigue. Men workers, on the other hand, frequently suffer a "letdown" on such work.

Women have long been active in various manufacturing work and we found it easy to employ those who had had experience in shop work of one kind or another, including radio manufacturing, plastics production and can machine operation. About 90 per cent of the 400 women we now have in our factory have had previous factory experience. Also, these women are all of mature character. Two-thirds of them are married, and more than half of them have one or more children at home. The average age of our women

Women are employed extensively in Vultee's drill-press department. Their competitive spirit and finger dexterity invariably results in increased production on these machines. One woman drills 1,000 pieces a day on one job—the best a man could do was 650 pieces

Gas welding aluminum parts is one job women can do well. Vultee is training them to electric weld fuselage structures and other jobs where separate crews set up the work in jigs. They will be started on welding fittings and small assemblies

After manning its trim department with women, where they could use scissors and needles to advantage, Vultee put them to work on subassembly operations. Many are now operating rivet guns and semi-automatic riveting machines

Feminine finger dexterity and women's capacity to do tedious jobs is exemplified by the assembly of electrical connections and fuzes shown here. Motion study and special assembly racks have greatly speeded the assembly of such units

workers is about 27 years. All of this combines to provide us with women workers who mean business.

Since we have been able to break our production work down into a large number of fairly simple operations, it was found possible to dispense entirely with pre-employment training. The women are put on work which can be taught in from two to eight hours. In this connection we find that the women take instruction better than most new men. They feel "green" and are not ashamed to admit it, so they pay close attention to instructions. Foremen report that the women will invariably do a job over and over again exactly as instructed.

Although the women do not receive pre-employment training, they are given every opportunity to attend the national defense classes conducted locally, and about 10 per cent of them do take outside class work in connection with their jobs. Furthermore, the women all show a strong competitive spirit. They are constantly seeking to prove that instead of being weak sisters they can actually outproduce the mere

Women at Vultee are doing a substantial part of all subassembly work. Here they are shown assembling hydraulic actuating parts to support brackets and control cables

males. Women have been worked mostly on the day shift and their usual habit, in the machine shop, is to check up on the number of parts produced by their male counterpart on the night shift. This sometimes takes quite a while, but they will invariably turn in and make up for lost time, finishing their stint by piling up more work than the man before them turned out.

One particularly tough job illustrates this competitive spirit as well as the unusual finger dexterity which makes it possible for the women to outproduce men on light work. A drill press job of drilling $\frac{1}{64}$-in. holes through a $\frac{3}{16}$-in. steel pin had developed into quite a bottleneck. Quite a few thousands were required but it was impossible to get a man operator up to more than 650 parts per shift. A tiny red-headed woman who had done some previous drill press work was given the job and, on her first day, turned out 830 parts. She apologized to the foreman and promised to do better, and on each succeeding day she turned out well over 1,000 units per shift. Even when shown what the woman was turning out the male operator could not get his production up over the 650 unit ceiling, indicating the advantage of the woman's nimble fingers.

Women are paid the same wage scale as men for the same work. Employment of women on the repetitive jobs has made it possible to up-grade the men faster than formerly, which helps to resign them to the idea of having women around the shop.

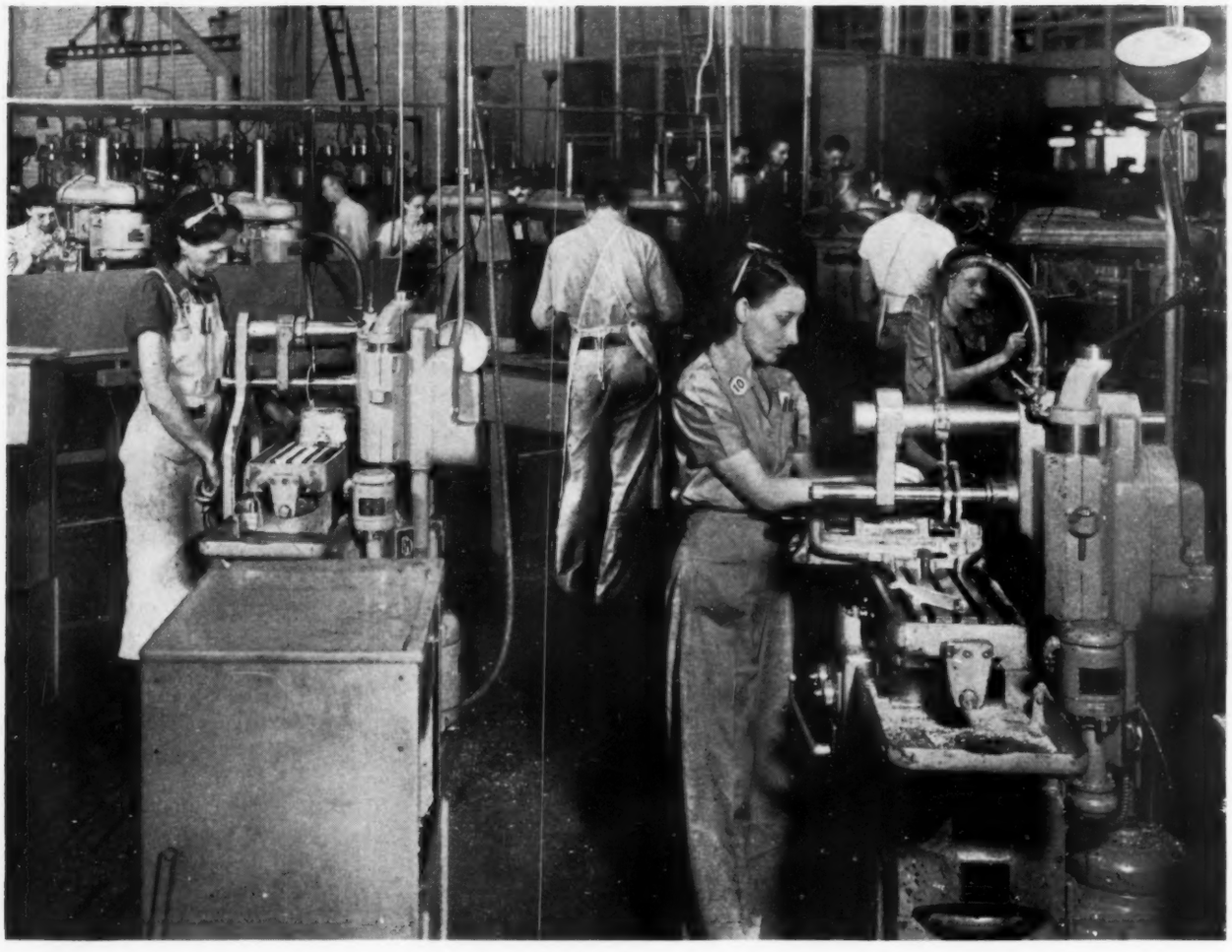
The women enjoy few special privileges. They have rest benches and special washrooms, but otherwise they are assigned to various departments and work among the men without much segregation. The women are required to wear slacks and solid toe, low-heeled shoes in the interest of safety.

Although the use of women in the machine shop is somewhat spectacular, they are being widely used elsewhere throughout the plant. Women are now doing gas welding on aluminum parts and we expect to have women doing electric welding soon on the fuselage structure. We will probably start them with fittings and small assemblies done at a bench, but there is no reason why they cannot progress to the larger subassemblies or even to the final assembly welding jig, since all work is laid up in the jigs by separate crews, leaving the welder with no heavy work at all.

Women are also doing a certain amount of delicate riveting with light rivet guns, and are operating the semi-automatic riveting machines for assembling certain subassemblies.

After manning our trim department with women, where they could use scissors and needles to advantage, we turned to the various small subassembly operations, particularly in the electrical department, where we hoped that feminine finger dexterity would speed operations. By a careful motion study and through special assembly racks we have been able to greatly speed the assembly of such units as electric control panels and fuse boxes by women workers. They have also done well in inspection work, and handle tools and gages with skill and remarkable accuracy.

We have also found it desirable to place women at many of the stations along our powered final assembly line. This assembly line carries the fuselage



Although women seem to work best at simple repetitive operations, some have proved their ability at complicated machine operations. Today they are running milling machines. Others are being trained to operate turret lathes and automatic screw machines

frame past various work stations at a height permitting workmen, and workwomen, to assemble the parts assigned to them with a minimum of effort. The floor is completely unobstructed, permitting the women to move around the fuselage without awkward bending or climbing. They assemble such parts as controls, map cases, floor boards and instruments, and demonstrate very satisfactory manipulation of wrenches and screwdrivers.

Women are also used on the engine section assembly line where controls, ignition harness, fuel and oil lines are mounted on the engine preparatory to its attachment to the plane.

But it is in the machine shop that women have made their most impressive progress. There they work side by side with the men on the burring bench work, drill press work, and now on some of the milling machines. We expect to advance some of these women to other machine work, such as light turret lathe operations and automatic screw machines.

Women assigned to the machine shop are usually those who have had previous machine experience, even if only filing and burring of small parts for radio manufacturers. We put these women on the burring benches at first, where they perform filing and burring work on small parts. They have a remarkable touch and turn out more and better work than most men doing a similar job. Those women who show special aptitude or who are specially qualified are advanced to light drill press work. Here their sensitive touch again shows up to advantage and they will invariably turn out more work with less drill breakage than the heavier-handed men, especially on very light drilling. In addition to drilling they also do reaming and spot-facing operations.

The two women who have been advanced to milling machine work have proved their right to a place alongside the men doing similar jobs. These women carry their own tool kits. They set up their work without help and use their tools, gages, and micrometers with all the skill and assurance of the male operators. Furthermore, they take a very special pride in their work because they realize that they are "on the spot" in direct competition with men in a man's chosen field. It would not be fair to say that the women do better work, or have a lower percentage of spoilage, but they certainly hold their own on many operations.

In spite of the fact that most women are more familiar with the mop and dishpan than they are with wrenches and micrometers, the ladies seem to learn at least as fast as the men on simple operations. This indicates that we have available a huge labor reservoir that can be drawn on extensively and without too much pre-employment training if our production program grows so vast as to require an effort beyond the capacity of the available men. These days the women are tossing aside their aprons and dust pans to become in all actuality "the woman behind the man behind the gun."

Feeds and Speeds for Milling with Carbides—I

THE FOLLOWING DATA on speeds and feeds should be considered as approximate only, since their selection for the most efficient results depends upon many conditions. The speed and feed for a given job should be selected from the accompanying charts, and then varied to suit conditions. The factors which apply to any milling problem, any one of which may be more important than all others, are: (1) material to be milled, (2) stock removal, (3) horsepower applied to the machine, (4) accuracy and finish desired, (5) type of cutter and material of cutter blades, (6) rigidity of work to be milled, (7) type of cutter set-up, (8) type of work-holding fixture, and (9) characteristics of coolant fluid used.

TABLE OF CUTTING SPEEDS

Material to Be Milled	Cutting Speed in Feet Per Minute For Tungsten Carbide Cutters		
	Roughing		Finishing
	$\frac{1}{8}$ in. Depth of Cut	Under $\frac{1}{8}$ in. Depth of Cut	Under $\frac{1}{16}$ in. Depth of Cut
Cast Iron—Soft	200–275	275–310	310–350
Cast Iron—Medium	125–225	225–260	260–300
Cast Iron—Hard	100–175	175–210	210–250
† Malleable Iron—(Free Cutting)	200–300	275–350	350–450
†* Cast Steel—(Free Cutting)	100–200	150–250	200–300
†* Low Carbon Steel—Soft	150–250	175–250	200–350
†* Low Carbon Steel—Medium	100–150	150–225	175–250
†* Low Carbon Steel—Hard	75–100	100–150	150–200
Brass	300–400	350–500	400–600
Ordinary Bronze	200–300	250–350	350–500
† Aluminum	800–1,200	1,000–1,500	1,500–2,000

Note: The cutting speeds for malleable iron and cast steel will be proportionately lower with the presence of sand or other abrasive material.
† Use coolant * Tantalum Carbide

Milling Speeds

The cutting speed, or the peripheral speed of the cutter, depends primarily upon the material from which the workpiece is made and the material used in the cutter teeth. The cutter speed in revolutions per minute at which a definite size cutter should be run can be calculated easily once the cutting speed has been determined. Select the proper cutting speed from the accompanying table, and then calculate the revolutions per minute from the following formula:

$$\text{R.p.m.} = \frac{12 \times \text{Cutting Speed (ft. per min.)}}{\pi \times \text{Diameter of Cutter (inches)}}$$

$$\text{R.p.m.} = \frac{3.82 \times \text{Cutting Speed}}{\text{Diameter of Cutter}}$$

The hardness of the work to be machined has considerable influence on the speed to be used. For example, high carbon steels having different heat-treatments will be milled at different cutting speeds.

Milling Feeds

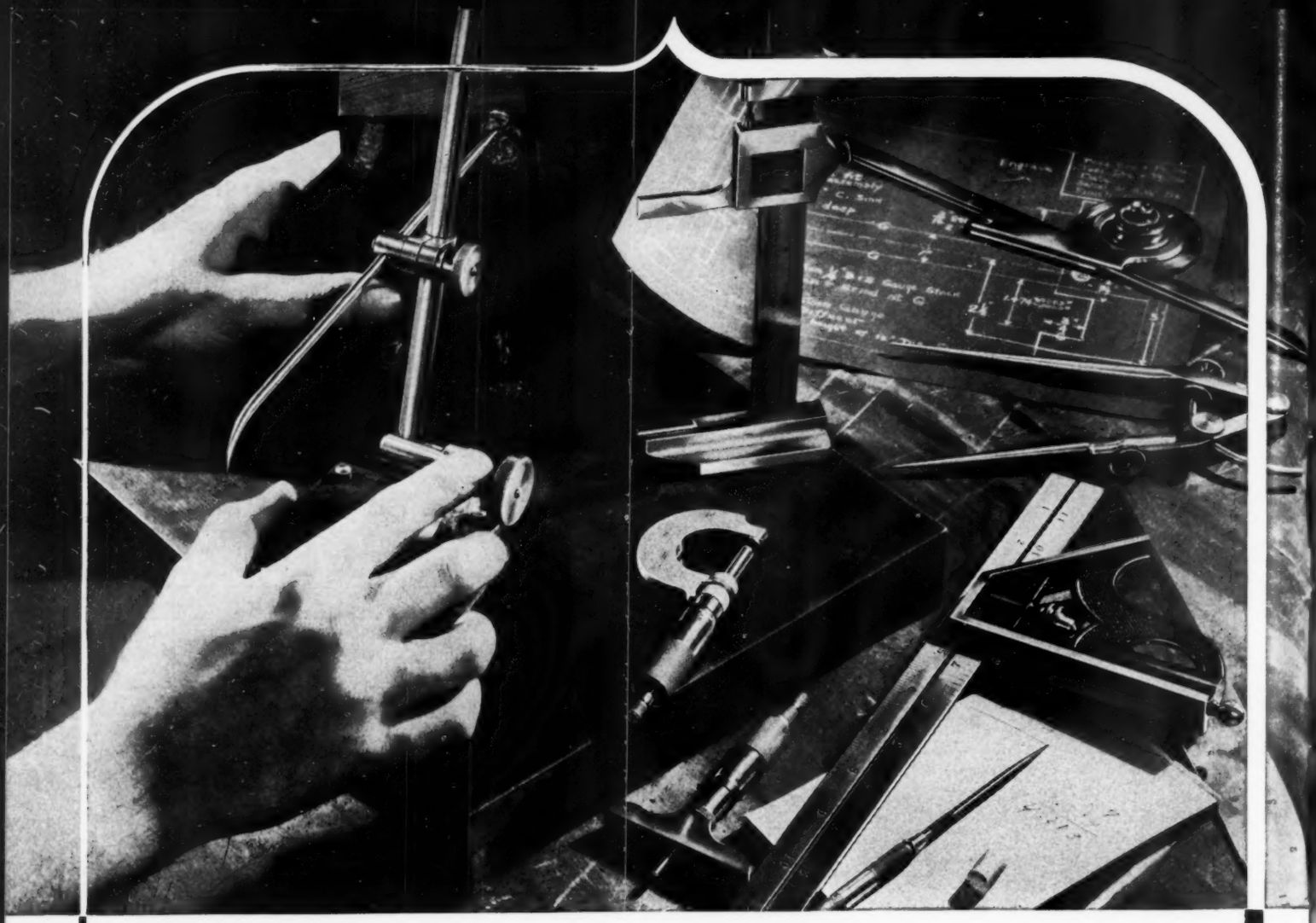
The selection of the proper feed rate for milling a given piece of work is subject to wide variations. In general, theoretical feed rates may be determined from the horsepower input to the machine, according to the following formula:

$$\text{Feed (in. per min.)} = \frac{\text{Horsepower applied} \times \text{constant } K}{\text{Total width of cut} \times \text{depth of cut}}$$

Values for constant K are listed in an accompanying table. They were obtained by testing various materials, and may be used with the above formula when determining feed rates for tungsten carbide cutters. When so used, all other conditions which influence the choice of feed are excluded. Of course, hardness of the material may alter the constants. As listed, they are for materials which have been hardened but slightly, and they would proportionately decrease as the hardness of the material increases.

In some cases, the entire capacity of the machine cannot be used because the thickness of chip per tooth obtained from the formula exceeds recommended practice. Too heavy a feed overloads the teeth of the cutter and very often causes breakage. Too light a feed will cause excessive wear because the teeth will pass in contact with the work more often than is necessary for a given length of cut. The accompanying table of feeds may be used as a guide for the thickness of chip per tooth. The feed rate calculated from the horsepower input formula should be checked with this table, since feed equals chip per tooth times the number of teeth times the speed of the cutter in revolutions per minute.

In other cases the entire capacity of the cutter or machine for metal removal cannot be used because of the accuracy and finish requirements of the work. Another determining factor is the rigidity of the work, fixture, cutter, and arbor. Work pieces that can be mounted firmly on the table and relatively close to its surface will allow a greater feed rate to be used. Work



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Feeds and Speeds for Milling with Carbides—II

pieces having a very light section, or those which do not permit adequate clamping, require a low feed rate to preclude the possibility of the piece springing. In some cases the nature of the set-up does not permit rigid support of the arbor or cutter. For example, the feed rate used in sawing is definitely limited by the strength of the saw. In addition, there are some set-ups in which the design of the part to be milled will not permit the proper use of arbor supports. In such cases, it is impossible to prevent the arbor from springing while cutting, so the proper feed rate must be determined from experience and good judgment. In some cases it is well to discontinue the use of cemented carbides in favor of high-speed steel cutters because of this springing condition.

Variable feed attachments available with some milling machines give variations in speed rates which are best suited for the economical and accurate production of certain jobs. It may be desirable to use a slow feed rate when the cutter is entering the work, or when flimsy, easily broken sections of the work move past the cutter, and then increase the feed rate as the cut progresses. If the work is rigid and clamped solidly, the machine may be kept at full capacity during the cut by maintaining a constant cubic removal of metal per minute, regardless of the width of cut. The feed rate is then determined solely by the horsepower input of the machine and is automatically increased or decreased so that the maximum horsepower is used throughout the cut.

In using cemented carbides, experience has pointed out several fundamental requirements that are all-important. These are: (1) the machine must have plenty of rigidity, speed and driving power; (2) the fixtures must be well designed to securely hold the workpiece; and (3) the cutting tools must be properly designed, rigidly supported and properly sharpened.

It is important that the operator be instructed in the technique of using cemented carbide tools, since this technique is quite different from that used for high-speed steel tools. In order to obtain the best results, the operator should be instructed to return the tools for replacement or sharpening, as soon as they show the slightest wear on the cutting edges. Sharpening the tools before they become dull will result in a saving in material to be ground off, and it will also help prevent breakage of the tips from the extreme pressure that will result when the cutting edges of the tools are dull.

Using a tool after it has become dull will result in poor finish. Should the tool become so dull that the horsepower required exceeds that supplied, the machine will stall and there is danger that the tips may be broken when the cutter is withdrawn from the cut.

When handling cemented carbide tools, care should be taken not to abuse the tips, such as dropping the tool or tapping the tip with a hammer while setting up. These tools can stand a certain amount of rough usage, but consideration should be given at all times to the fact that a cemented carbide, while extremely hard, is weaker than steel.

Power Required for Milling

The horsepower required for milling is dependent upon many variable factors, including the cutting speeds, the feeds, the material being milled, the rake angle of the cutter, the keenness of the cutting edges, the depth of cut, the smoothness of the face of the teeth, the type of cutting fluid used, etc. However, the following empirical formula can be used for a rough determination of the power required in milling:

$$\text{Hp} = \frac{DFW}{K}$$

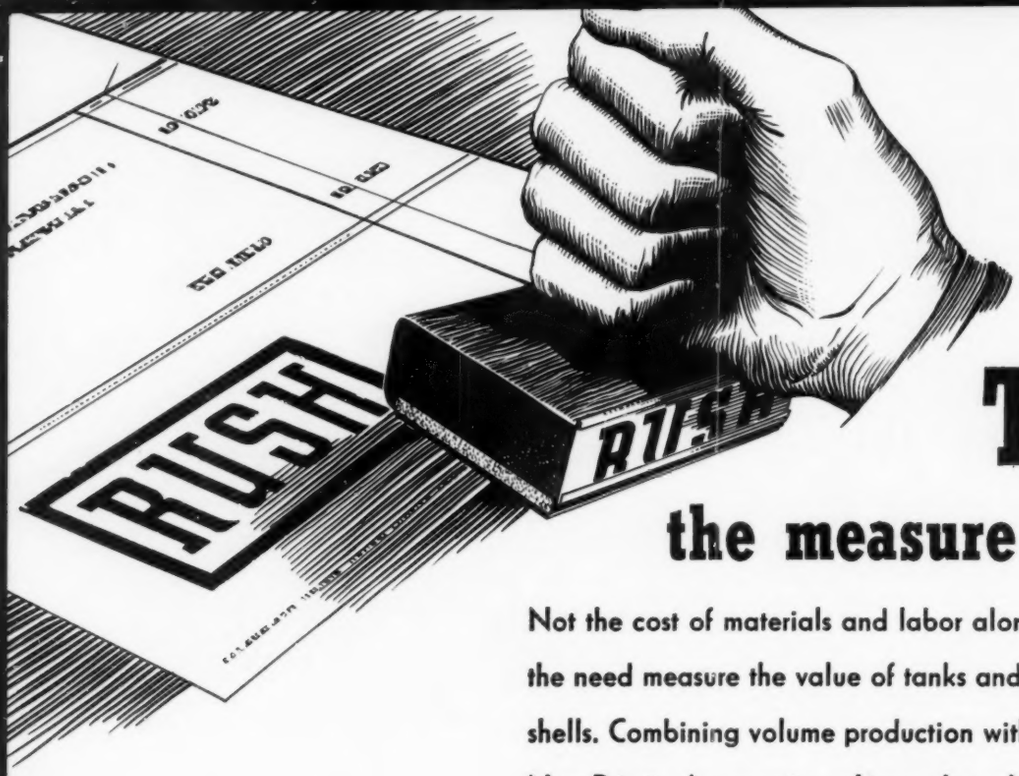
In the above formula, H = horsepower actually used in cutting; D = depth of cut, in inches, F = feed rate, inches per minute; W = width of cut in inches, and K = a constant which varies for different materials. This constant K represents the cubic inches of metal removal per minute per horsepower. In each case, the constant is an approximate figure and the final horsepower required may be affected by several of the foregoing factors.

Table Of Feeds (Per Tooth Per Revolution) For Tungsten Carbide Face Milling Cutters

Material To Be Milled	Roughing Depth $\frac{1}{8}$–$\frac{3}{16}$ in.	Finishing Depth $\frac{1}{16}$ in. or under
Cast Iron	0.008–0.014 in.	0.006–0.008 in.
Malleable Iron	0.008–0.014 in.	0.006–0.008 in.
Brass	0.010–0.016 in.	0.008–0.010 in.
Bronze	0.010–0.016 in.	0.008–0.010 in.
Aluminum	0.012–0.018 in.	0.010–0.012 in.
Steel	0.004–0.008 in.	0.003–0.006 in.

Values of Constant K

Material	Bed Type Machine	Knee & Column Machine
Cast Iron	1.50	1.00
Mild Steel	0.75	0.50
High Carbon Steel	0.65 to 0.75	0.40
Alloy Steel	0.50 to 0.75	0.35
Malleable Iron	1.20	0.75
Brass & Bronze	2.00 to 3.00	2.00
Aluminum	2.00 to 2.50	2.00



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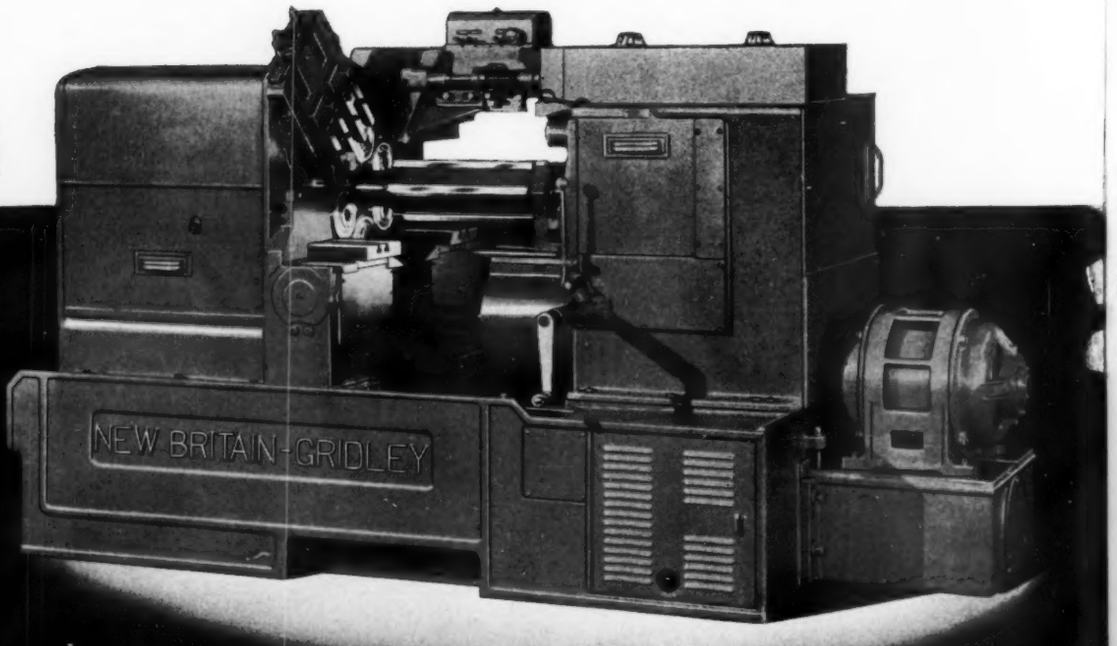

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Give Morale a Boost

MORALE is something you cannot buy. It is not a commodity which can be purchased. Yet the state of a country's morale may spell victory or defeat.

The collapse of France was hastened by a morale sick unto death. The British, by contrast, got their backs up after Dunkirk and gave an exhibition of courage under fire which amazed the world.

America's morale today leaves much to be desired. That statement applies to industry as well as to the Army and to the country as a whole. By "industry" we mean both the employer and the men in the shop.

So far as the employer is concerned, we shall take up his case another time. Just now we are concerned about his employees.

The men like the longer hours and the fatter pay envelopes as a result of the defense program. They are not so keen about working second or third shifts. They have little enthusiasm for working week-ends.

In short, many employees are not "shooting the works" in an effort to get out more production. It's a great thing to have all of this prosperity. It is a sort of skylark, not a national crisis which closely touches their lives.

In England the sensitiveness of workers to the desperate Russian situation brought almost overnight an increase of 20 per cent in tank output.

Over here defense officials say that an equal sensitiveness on the part of American workers to the urgent need for speed would raise production as much as 30 per cent.

How can the morale of the man in the shop be raised so that he will give his best to his job? Several ways suggest themselves.

1. Meetings of workers should be held periodically. At these meetings speakers would show the direct relationship between the men's shop efforts and military operations with their products. Such meetings have proved of considerable value in England.

2. Army and Navy men should rub elbows more frequently with shop men at their work. Let the two groups—the military and the industrial—get acquainted with each other. A unity of purpose is likely to emerge from such contacts. The Army is successfully doing something along this line now.

3. The employer's own attitude and actions can have a profound effect on the men in the shop. If he is putting everything he has into his defense job, they are more likely to do their full share. If he loafs or is indifferent, they are likely to follow his example.

4. The federal government itself, more particularly the White House, should speak out the plain unvarnished facts to the men in the shop. The government is theirs; they helped elect it. A clear-cut appeal, telling exactly where we are, not glossing over disagreeable matters, not pulling any punches, treating the situation realistically and pointing out the plain duty of every worker, should help tremendously to wake up the indifferent employee and to get the desired increase in efficiency.

Higher morale means higher defense production. It can be achieved. No miracles are required. Let's achieve it.

Burnham Finney

GAGING BUSINESS

Tank program schedules 60-ton monsters. Plants tool up to make 100 a month. Production of $2,000,000,000 of machine tools in 1941-43. Light trucks curtailed to assure heavy transports

For the first time the government's defense program now calls for the manufacture of heavy tanks as well as of medium and light tanks. The fact was known that the Army had been experimenting with heavy units. Today the news is revealed that 60-ton monster tanks will be a part of the manufacturing schedule of U. S. tank builders. It is expected that plants will be tooled up for a production rate of 100 a month.

Machine Tools—Machine-tool builders have been given assurance privately that around two billion dollars worth of defense orders will be allotted them in the next two years. That would be an average of one billion dollars annually. The industry this year will attain its goal of $750,000,000, but today is operating at an annual rate in excess of $840,000,000. It appears likely that output in 1942 can be stepped up to a billion-a-year basis. Russia, in dire need of help from America, is asking for $40,000,000 of machine tools to rebuild her industries east of the Urals outside of the territory conquered by Germany. England wants $100,000,000 of machine tools. China and the Netherlands East Indies also are clamoring for machine tool shipments to build up their war industries. Machine-tool builders have received orders for about $112,000,000 of the total of $200,000,000 made available for the so-called "E" pool for the big bomber manufacturing program. This pool is intended to create a reservoir of machine tools upon which subcontractors on the bomber program can draw for aid in tooling their plants. Thus far the specific machine requirements of these subcontractors are not known and it is not desirable to wait longer to produce at least a portion of the machines which will be needed. Further enlargement of plant facilities is planned by companies making the so-called critical tools in which deliveries are tightest. Builders still are in the process of drawing more men into second and third shifts. At present the industry is running more hours per week per man than any other U. S. industry.

Aircraft—Acceleration of plane production is still held down by lack of propellers. Bell Aircraft Corp. has Airacobras already test flown and accepted by the Army, but which cannot be delivered because of propeller shortage. Engine shortage which helped slow program for a while has been eliminated. Enough will be produced to keep supply safely ahead of plane output. Last month exports were large without curtailing home use. Besides Britain, China, Dutch Indies and Russia will get engines. Several Russian planes are built for U. S. engines. Last week the War Department made contracts worth $30,564,523 for propellers and parts.

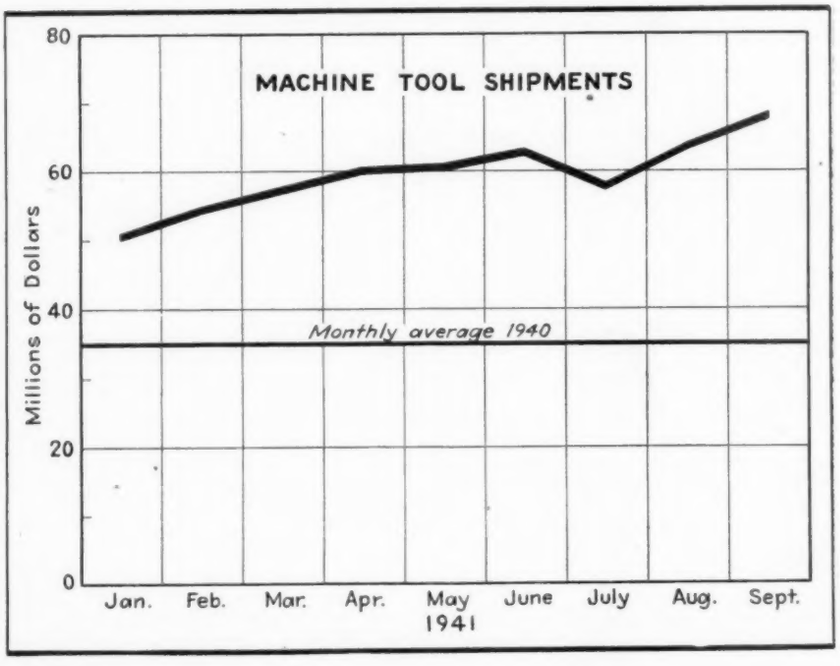
Trucks—Production of light commercial trucks for civilian use has been cut 29 per cent from the last model year. Move restricting trucks of less than 1½ tons was made to insure materials for heavy transport trucks. Some expansion of heavy trucks may come as a transportation shortage looms.

Munitions—Tank builders are now geared up to make 600 medium (M-3) tanks a month, but will expand their facilities so that 2,000 a month can be built by the middle of 1942. However, no more tank arsenals like the Chrysler arsenal will be constructed. Chrysler is considerably ahead of schedule and is supplying other tank makers with essential parts as well as turning out complete units at a good pace. In certain classes of guns production is now approaching a mass basis. The fuze manufacturing program is in excellent shape, somewhat ahead of projected output. In many instances the government's new ordnance plants, of which close to 70 eventually will be in operation, are opening before the scheduled dates. The entire ordnance production program of the Army is close to the timetable set up for 1941, despite, diversion of machine tools to aircraft and tank jobs.

Steel—So far only 2,500,000 tons of the 10,000,000-ton expansion of steel capacity recommended by OPM have been scheduled. Remaining tonnage will be booked soon. Much of the expansion now under way will be completed within five or six months. Full operation is doubtful because there appears to be no adequate source of scrap metal. Pig iron expansion has reached 5,400,000 tons per year. Little more will be added despite earlier OPM suggestion of a 6,500,000-ton boost.

Small Arms—Pistol manufacturers will retool to produce carbines, now that the Army has decided to replace pistols with the new weapon. As 973 men in each infantry regiment will carry carbines, hundreds of thousands will be required. Army selected a Winchester design but will make contracts with several companies.

Railroads—Some 650 locomotives are on order for next year, but companies want 800. Emphasis will be placed on switch engines. If there were more of these, freight car time wasted in terminals and yards could be sharply cut, actual use of present facilities would increase and help given to alleviate space shortages. Freight car building in September was a current record of 6,575 units. Such a rate would take care of 1942 traffic. It is doubtful, however, that such a pace can be maintained. Tanks and ships, whose programs are being accelerated, come first for armor plate, an important component of freight cars.



PRODUCTION TEMPO RAISED TO WIN WAR SOON

Copper order signalizes all out effort for 1942 victory over Hitler. Strategy change tosses "business as usual" out window. Aid Reds

By ROBERT COLBORN

WASHINGTON—SPAB's order forbidding the use of copper next year in a long list of civilian articles is simply the first step in a merciless program to slash non-defense industry to the bare minimum. A whole series of equally drastic moves can be expected on other materials. A new tempo, a more determined attitude, has been developing in Washington the past month. It really looks now as if "business as usual" would get short shrift.

The changed war situation is in part responsible. Until last June, U. S.-British strategy was drafted in terms of a long war—a rear guard action against Hitler until 1943 or 1944. This set a relatively leisurely tempo of production increase, adjusted to permit an orderly and fairly painless transition from a peace to a war economy. Development of the Russian war has for the first time opened the possibility of a short war. If the Red army can be kept in being and fed with enough arms from this country and Britain, it is conceivable that Hitler may be defeated in 1942.

Speed Essential

This means that the speediest increase in arms output becomes an essential part of administration strategy. Significantly, one high administration official is handing out to visitors copies of Louis Marlio's Brookings Institution pamphlet, "A Short War Through American Industrial Superiority." And SPAB Director Donald Nelson has taken to saying that severe sacrifices for eighteen months are to be preferred to a decade of lean times.

Corresponding to the changed policy is changed personnel. New Dealers in the main have taken over policy-setting from the dollar-a-year men. They have found in Nelson a business man who—on war—sees things their way. It is Nelson and Leon Henderson, and to a lesser extent men like Harry Hopkins and Isadore Lubin, who are running things, rather than the more conservative Knudsen, Stetinius, Biggers, and the like.

Every Move for Increase

You can discount many of the stories coming out of Washington indicating an immediate doubling and tripling of delivery schedules; there are physical limits to what can be done. But, you can count on it that every move that will increase production will be made, regardless of what civilian interests it tramples on.

Symptomatic is the Navy's latest move to step up its warship program. Turbine and generator builders have been ordered practically to halt work on their orders for power companies and concentrate on Navy equipment. This is going to mean power rationing in hundreds of places next year, but it's being done regardless.

SPAB's copper order forbids the use of copper, after the first of January, in the manufacture of a list of specific items. The list includes practically all copper-bearing consumer articles; nearly all building, plumbing, and heating supplies; and a number of auto accessories — lamps, heaters, horns, hardware, etc. For the period between now and the end of the year, use of copper for these purposes must be reduced by some 40 per cent.

Auto Production Doubtful

No essential use of copper for automobiles has been banned by the order. But the tight copper situation emphasized by SPAB's move raises very serious questions whether it will be possible to continue manufacturing cars in any substantial quantities for more than a month or two. This month there is not enough copper to fill all the priority-rated orders. There are no priorities for passenger cars, and there appears to be little disposition in the defense agencies to grant such priorities.

The only way the auto people can get copper over the next few months is by using their buying pressure to force suppliers to put their orders ahead of priority rated orders. Washington suspects that that's the way they have been getting deliveries for some time now. Defense officials are determined that such diversion shall stop. A drive is underway for rigid enforcement of priority ratings—as evidenced by this month's crackdown on an aluminum foundry (Central Pattern and Foundry Co.) which diverted metal bought under ratings to the manufacture of juke boxes and slot machines. Buyers, who knowingly take such products, also will be penalized.

Deliveries Slowed

All this seems to mean that auto companies are not going to get many more copper deliveries. Most of them have about a six-week inventory on hand, and they have not been getting deliveries for several weeks. No one to date has found an adequate substitute for copper in radiators.

Nor is much loosening of the situation likely next year. Total "non-essential" civilian demand is estimated at 1,100,000 tons. To meet this, after deduction of defense and essential civilian needs, is some 350,000 tons—all of it subject to the hazards of shipping shortage and enemy action in the haul from South America. High priority ratings have been assigned for equipment going to South American mines.

Continuous Tool Production Sought; FDR Turns on Heat

WASHINGTON — Practically continuous operation of facilities for producing critical machine tools is being sought by the Administration. As a follow-up to OPM Director Knudsen's plea to builders for seven-day schedules, increased man-hours on night shifts and broadened subcontracting, President Roosevelt, who urged a 24-hr. day and 7-day week on April 30, is expected to turn on the heat.

One obstacle to be melted down is prohibition of Sunday work. Thirty-seven states have such statutes and nine more have laws requiring one day of rest in seven. A survey of this legislation and enforcement is being conducted in the interest of machine tool builders.

Most pressing obstacle is the attitude that plagues all industries, labor and the public—lack of appreciation of our danger and of the urgency of all out production. Knudsen, SPAB's Nelson, Price Man Henderson and Assistant to the President Lubin emphasize this factor.

Labor Cloaks Reuther Plan With Super Planning Board

DETROIT—Labor's coming drive for a super planning board is another attempt to force adoption of the Reuther plan. Representatives of labor, industry and government would sit on the board with full power to allocate defense production.

Support will be sought through labor's claims that: auto plants could have been converted to defense work almost a year ago, but the industry preferred to erect new plants to avoid disturbing auto production; the larger part of existing equipment can be converted to defense production and maximum utilization of facilities and labor on defense will not be achieved as long as companies are allowed to take contracts according to their "selfish" wishes.

Highest worker morale, labor leaders contend, cannot be expected until its representatives are in a position to help guide the production program. A further argument is that experience gained on the board will prepare labor for a part in shaping policies during the readjustment period following the war.

Howe Tells Tool Engineers Canada Depends On U. S. Despite Large Production Increase

TORONTO—While Canada's machine tool industry has been expanded more than 600 percent, she still has to depend on the United States for the bulk of her requirements, the Hon. Clarence D. Howe, Canada's Minister of Munitions and Supply, told the international meeting of the American Society of Tool Engineers. He complimented the machine tool builders for their record of keeping deliveries so close to schedule in the face of increasing demands.

Mr. Howe also informed the more than 600 delegates that Canada's potential output of war materials had been underestimated in the mapping of the program because Canadian plants were largely equipped from British manuals, in which machine-tool and man-hour requirements were set forth. The rate of output of modern machine tools made in the United States is much greater than anticipated. Frank W. Curtis, chief engineer, milling machine division, Van Norman Machine Tool Company, and A.S.T.E. president, presided at the dinner addressed by Mr. Howe.

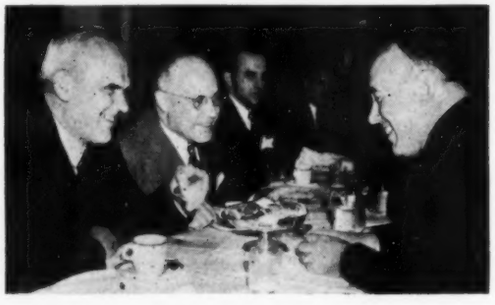
Meeting was divided between visits to nearby plants making ordnance material and three technical sessions. Twelve plants opened their doors to delegates from the United States. Operations observed included manufacture of machine guns, high explosive shells, shell cases, fuzes, airplanes, 3.7-in. and 40-mm. anti-aircraft guns, fire control apparatus and bomb sights.

Highlights of the technical sessions included a round-table discussion of the use of old or new machine tools for ordnance production by Fred Dull, vice president, Monarch Machine Tool Co.; A. E. R. Turner, vice president, John Bertram & Sons Co., and Arnold Thompson, president, Tool Engineering Service and general chairman of the convention. At this session, Thomas Arnold, Canadian Machine Tools Controller, summed up the discussion by urging the use of used machine tools on war production until such time as more efficient new machines can be obtained. Mr. Dull started his discussion by saying that "This is no time to argue the question of new machines versus old machines—we can do that when the war is over."

He pointed out that in many instances old machines are not capable of the accuracies demanded and can not stand up under the strain of using modern cutting materials. He also told the members that while the American machine tool industry normally makes about 2,500 units each year, the total for 1941 will be in the neighborhood of 200,000 machines and many of these will be more than three times as productive as the average machine tool in use two years ago.

Roy T. Wise, Deputy Machine Tools Controller for Canada; Philip M. McKenna, president, McKenna Metals Co., and Walter Esau, E. F. Houghton Co., participated in a discussion of means for getting the most out of cutting tools. General arrangements for the meetings were made by Ed. Barker, president, Modern Tool Works Ltd., and William A. Dawson, chief planner of ordnance, Otis-Fensom Elevator Co.

A. E. R. Turner, vice president, John Bertram & Sons Co., and Fred Dull



Above, C. H. Barneman, General Electric Co., and A. H. d'Arcambal, Pratt and Whitney Division, Niles-Bement-Pond Co.

At left, Hon. C. D. Howe, Frank W. Curtis and James Y. Scott, president, Van Norman Machine Tool Co.

Above, Roy T. Wise and Thomas Arnold

At left, P. W. Brown, assistant works manager, Wright Aeronautical Corp.

At right, Arnold Thompson

N.M.T.B.A. Discusses Defense Program, Asked By Washington to Operate Under War Economy

CHICAGO—Devoted almost exclusively to discussions of aspects of the national defense program affecting machine tools, the fortieth annual meeting of the National Machine Tool Builders' Association, held Oct. 13-14, brought out a large attendance. The address of Frederick V. Geier, president of the Cincinnati Milling Machine Co. and retiring president of the association, the report of the defense committee headed by Clayton R. Burt, president of the Pratt & Whitney Division of the Niles-Bement-Pond Co., and the speech of Mason Britton, chief of the Tools Section, Office of Production Management, were outstanding features.

Ways and means of increasing further the production of machine tools were considered at the various sessions. Clifford S. Stilwell, executive vice-president of the Warner & Swasey Co., in his capacity as the newly-elected president of the association, struck the keynote for the coming year when he asserted at the final session that the industry "is not fighting the government in Washington; it is fighting Hitler." The association members unanimously adopted a resolution saying that the machine tool builders "will do their duty."

Setting Similar to 1916

Pointing out the similarity in setting between the current meeting and that of the association 25 years ago, which was the last one before the United States declared war on Germany, he emphasized what the industry has done thus far to meet this emergency. Output this year will be $750,000,000. Prior to June 10, 1940, 130 companies utilizing their own resources received 247 certificates of necessity for plant and equipment expansion amounting to $53,537,402. That does not include the more recent expansion of 27 companies employing government emergency plant facilities contracts for $25,499,649. A report from association members indicates that 39 firms are still in process of adding to building capacity and 64 to productive equipment. Sixty-seven companies, acting on their own initiative and with their own funds, had completed over 2,400,000 sq. ft. of additional floor space and installed the necessary machine tool equipment during the 12 months preceding the opening of the defense program.

Though 6 to 12 months usually is required to build the important machine tools, said Mr. Geier, "the cases where defense production could not commence because the new machine tools were not on hand have been few. Far more frequently machine tools have been delivered to defense plants well in advance of the time they could actually be put into production."

Shipments by the industry in September were nearly twice those of a year ago, declared Mr. Geier. Just over two years ago 110 firms, accounting for 90 per cent of the industry's employment, had 44,000 workers. In September, 1940, the number had risen to 68,000, and last month to 92,000. Despite this great increase in employment, the industry still has over 12,000 men in training.

GEORGE H. JOHNSON

Work Over 100 Hours

By February of this year, said Mr. Geier, 40 per cent of the employees in the industry were in three-shift plants, and by last month the three-shift basis had further increased to 53 per cent. Some 87 per cent of the plants are working over 100 hours and up to 168 hours a week. The National Industrial Conference Board reports that the average hours worked in machine tool shops are the highest in American industry.

Mr. Geier stressed that a large increase had taken place in the amount of work subcontracted. Eighty-nine firms are now subcontracting parts, units or complete machines in an amount exceeding 25,000,000 manhours a year. Six months ago 56 kinds of machine tools were being completely subcontracted by 28 machine tool builders. Today the number of companies has risen to 36.

C. S. STILWELL

The increase in capacity of existing plants and the widespread subcontracting by members of the industry have been supplemented by the output of a variety of new sources, remarked Mr. Geier. In five important machine tool groups alone, in addition to the 54 pre-war builders, there are today 45 new sources. For all types of machine tools there are at least 72 new machine tool producing sources other than the subcontracting sources previously mentioned.

Improvement Called For

While the industry's over-all performance speaks for itself, said Mr. Geier, in some types of equipment the turn of events calls for decided improvement. This demands prompt action. In closing, Mr. Geier said, "Let us renew our pledge, 'Tell us the needs and we will deliver the goods.'"

Mr. Britton brought direct from Washington the request of defense officials that the machine tool industry operate entirely under a war economy. He put emphasis on the growing needs for defense—the step-up of the bomber

E. C. BULLARD

TOOL MEN ELECT OFFICERS

CHICAGO—Clifford S. Stilwell, The Warner & Swasey Co., has been elected president, and George H. Johnson, Gisholt Machine Co., first vice president of the National Machine Tool Builders Association. Other officers include: John S. Chafee, Brown & Sharpe Mfg. Co., second vice president; E. C. Bullard, The Bullard Co., treasurer. E. Blakeney Gleason, Gleason Works, and Albert H. Eggers, Greenlee Bros. Co., have been named directors for three years.

A. H. EGGERS

E. B. GLEASON

F. V. GEIER

and tank programs. He said that demand the next two years for machine tools will be around one billion dollars a year. It will be necessary, therefore, for the industry further to speed up deliveries and to get out more tools. He strongly urged builders to put more men on second shifts, to subcontract more work and to eliminate from their products those features which are in the "gadget class" and do not contribute directly to greater accuracy and efficiency. He suggested that companies not now fully engaged take on the manufacture of machine tools for other and busier companies.

Officers Cannot Change Ratings

Howard W. Dunbar, technical chief, Tools Section, OPM, recounted the survey made by the industry under his direction of the first 50 companies on the numerical preference list of defense contractors to get machine tools. The survey was so successful that a similar one has been undertaken of the so-called "500" bomber program and later the tank program will be analyzed.

Builders were urged by Mr. Dunbar to fill out and return more promptly to OPM the cards showing shipments of machines. He passed along word from the Army and Navy Munitions Board that district ordnance officers of the two services do not have the right to change a priority rating. He emphasized that the Air Corps officials at Wright Field control the release of machine tools made for the so-called "E" pool for bomber subcontractors.

Wendell E. Whipp, president of the Monarch Machine Tool Co., reported as chairman of the committee on color standard that the vote of a majority of association members which expressed any preference was in favor of the lighter General Motors color. William J. Kelly, president, Machinery and Allied Products Institute, talked to the members briefly about Washington activities affecting the industry. Tell Berna made a report as general manager of the association. Ralph E. Flanders, president, Jones & Lamson Machine Co., and Robert M. Gaylord, president, Ingersoll Milling Machine Co., were among those who participated in the executive session on defense matters.

H. W. DUNBAR

REPAIRS GET RATING

WASHINGTON—Because many thousands of industrial and service plants, both defense and civilian, must be kept going in the public interest, OPM Division of Priorities has granted a rating of A-10 which they can use to get maintenance and repair materials. It is an amendment to Order P-22. Any concern qualified to use the rating can do so without making application, simply by making a statement on the face of its order.

Since A-10 is a defense rating, the supplier must accept it. The supplier, in turn, may extend the rating in the same manner. Purchase orders for repair and maintenance must be made out separate from other. The extension of rating covers: government units and concerns engaged in manufacturing, processing, fabrication, warehousing, charity, transportation, education, printing, communications, hospitals and petroleum production.

Tool Builders' Resolution Backs Wide Spread Expansion

CHICAGO — The National Machine Tool Builders Association, meeting Oct. 13-14, passed the following resolution:

Whereas the machine tool industry, conscious of its responsibility for serving the national defense, increased its production in 1940 from $225,000,000 of output to $425,000,000, and has pledged itself in 1941 to $750,000,000 of output, and so advised Mr. Knudsen in January, and

Whereas this has been accomplished by an ever-growing volume of subcontracting of parts and complete machines, and by the training of men for second and third shift operation on the critical tools, to the point where more than a half of all its employes are now at work in plants operating on a three-shift basis, and

Whereas Mr. Knudsen, in his letter of Oct. 8, still further asks us to increase wherever possible the manhours on night shifts, to develop subcontracting to the greatest possible extent and to work critical tools seven days a week, therefore

Be it resolved that we will expand to the fullest extent the day and night operation of those critical tools on which the output of our shops depends, and that we will continue with full diligence to expand the volume of our subcontracting of parts and complete machines of all the critical types, and that we will expand this critical production to the fullest possible extent by Sunday work; but, in view of the fact that in general none but those industries in which continuous operation is a physical necessity are now so working, and in view of the fact that attempts to operate seven days a week have met with the obstacles of state laws, and sincere religious conviction, therefore

Be it further resolved that in view of this request, we in turn request of the national administration, that it give increasing attention in its public statements and its policies toward labor and the general public, to strengthening such a sense of national unity as will make it possible for us and for all other co-workers in the great undertaking to use our skill, experience, energy and ability to the limit, whether by seven-day operation or by any other practical means whatsoever.

The machine tool builders of the United States will do their duty.

GEAR SALES INCREASED

WILKINSBURG — Industrial gear sales for the first nine months of 1941 were 97.7 per cent higher than in the same period of 1940, according to the American Gear Manufacturers Association. September sales were 32.8 per cent above September, 1940, but 12 per cent below August, 1941.

INSIDE DETROIT

Auto industry must find copper substitutes. Small parts plants join hands to seek defense contracts in plan that would divide operations. UAW-CIO urges 160-hr. week in defense plants

BY RUPERT LEGRAND, DETROIT EDITOR

DETROIT—Confusion reigned in Midwest auto and parts plants last Tuesday when Washington's interpretation of the copper conservation order M-9-c was published. It appeared that there would not be an adequate supply of the red metal for radiators, wiring, starting motors and generators. But analysis of the priority order in Detroit revealed that the consumption of copper in these vital components is not restricted or prohibited in such manner as to affect car and truck production under quotas established through January.

So far as the auto industry is concerned, steps must be taken to find substitutes for copper after Jan. 1 in the following categories: garage and automotive repair equipment, headlamps and headlamp parts, heaters, horns, hub caps and gas tank caps, miscellaneous fittings and trim, moldings, rear-view mirrors and hardware. Until Jan. 1 the use of copper in these products is restricted to 60 percent of the 1940 base period; after that date such use is prohibited. Copper plating is permissible on these parts if it is not primarily for decorative purposes, or if use or normal wear would make another form of coating impractical.

Germany Had Only 175,000 Tons

As stated on other occasions the automobile industry has had difficulty in understanding why huge quantities of critical materials are needed for defense purposes. Projected military requirements for copper were set at 850,000 tons in midsummer, rose to 1,000,000 tons a few weeks ago and are now 1,050,000 tons. Germany on the other hand had available in Continental Europe, except Russia, only 175,000 tons in 1940. If Russia falls into German hands it can expect to secure a copper industry which produced only 102,000 tons in 1940.

Assuming that all copper available to Germany in 1940 went into munitions, it is seen that our predicted defense and lend-lease requirements are six times as great. Of nickel, Germany had only 1,400 tons out of a world production of 120,700 tons in 1940. Yet our military requirements of nickel for 1942 are projected as 40 times the entire German production last year.

In a self-help program, authored by Frank Rising, general manager of the Automotive Parts and Equipment Manufacturers Association, and designed to secure defense contracts for small parts plants in anticipation of a severe letdown in automotive orders, a Stamping Manufacturers Committee visited Washington last week. They were to meet with Alex Taub, consultant in the OPM contract service to ascertain what defense orders can be executed through concerted effort of several or more manufacturers, which individually do not have the equipment necessary to handle a contract.

Little Relief in Sight

Such shops expect little relief from automobile companies in the form of subcontracts, because the larger concerns will themselves have thousands of idle presses. Cooperation in the program has already been obtained from 80 concerns, of which a fifth at least are not members of the APEM. Consultation between the Committee and OPM is expected to reveal jobs that can be handled by distributing the operations required among several plants in the same locality or geographical area. One shop might handle the press work, another the welding, others the operations needed to complete the piece. Schedules of equipment and employment on defense and non-defense work, drawn up by the participating firms, will serve as guidance to the production experts on the Committee. Object is, of course, the relief of stamping plants which face idleness, but if the pooling of plant resources works out satisfactorily there is no reason why similar steps can not be taken for other sectors of small business faced with distress.

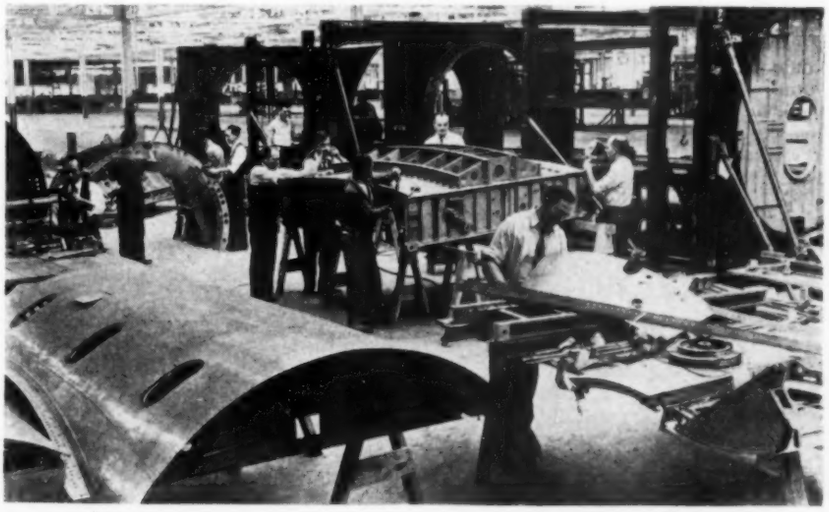
Union Picks on Tool, Die Shops

As part of a campaign of criticism leveled at industry's record on defense production, the UAW-CIO chose to take the automotive tool and die shops to task, alleging that they are operating at "no more than 35 percent of capacity." In 34 out of some 300 tool and die plants in the Detroit area, the union found that 377 of 1577 machine tools were idle and that the balance operated only 70.4 hr. per week. The union urged that all plants should work 160 hr. per week and steps be taken to coordinate the full use of idle equipment so as to effect immediate transition of the auto industry to defense production.

Other sources maintain that the tool and die industry is making approximately full use of the productive capacity and labor suitable for the manufacture of tools, dies, jigs, fixtures and gages. Of the shops alleged to have idle equipment and to be working short

DETROIT LAYOFFS ESTIMATED

Detroit—Anticipated layoffs in the metropolitan Detroit area for the period Sept. 1 to Feb. 28 total 53,735, according an analysis completed by the Michigan Unemployment Compensation Committee. Rehires are estimated at 20,938, leaving a net unemployment of about 33,000. Layoffs arising from material shortages in refrigerator plants will swell this figure to 50,000. The survey covered 428 companies employing 385,000 workers last summer.



Learning by Doing—*Foremen, who will supervise building of Martin medium bombers in the new Chrysler Corp. plant, are trained by actually putting plane together. More than 200 will be given an 8-weeks training course followed by several weeks in a Martin plant*

time, there are reasons peculiar to the nature of the work ordinarily done which have prevented full employment on defense. In the manufacture of large body dies, for example, the equipment used to rough the die blocks will not work to the tolerances required on many defense tools.

Fewer Bench Hands Needed

The short-time accusation is answered in this way: defense dies (for bomber parts) do not require the bench work of automobile dies. Not as many bench hands are needed. Despite the fact that such men can get immediate employment at Briggs, Hudson, Packard and other defense contractors, the union shop committee has called for a 32-hr. week. But the short work week is unattractive to the skilled machine operators who ask for a transfer to defense plants working full time, a procedure which is possible under the new seniority agreements. However, with a suitable raise, the skilled men are willing to stay on a 32-hr. week basis. If the employer raises these men, he must do the same for the entire shop. And after the wage increase is obtained, the 32-hr. week can be called off.

OPA Studies Price Ceiling On Tools; Cost Data Given

WASHINGTON—It will be another three or four weeks at least before any price controls are set up for machine tools. Last week's meeting of a group of 18 or 20 manufacturers with Price Administrator Henderson, was described by government officials as purely exploratory.

Tool builders have it was intimated agreed to furnish additional data, principally on production costs. Another meeting will be called in three or four weeks. Earlier in the month the group held preliminary, informal talks with Henderson. At that time they expressed a hope that an agreement could be made with the Office of Price Administration, under which prices could be escalated upward when and if necessary.

While some observers say that OPA is determined to impose a price ceiling OPA still says only that maximum prices are being considered. Under the "escalator" plan OPA would give consent to raises; no ceiling would be set.

WIDE REQUISITIONING

WASHINGTON—Defense planners believe that under the recent property seizure bill they can legally requisition almost any machinery in non-defense plants. It is certain that machinery "not necessary" for plant operation will go into defense production. Following that, tools and equipment will be taken from idle factories. One widely mentioned source is excess automobile capacity. All this results from pressure for more and more munitions.

Odlum Certifies 10 Mid-west Communities For Consideration in Defense Contracting

WASHINGTON—OPM's Contract Distribution Division, headed by Floyd B. Odlum, has certified seven Middle West communities to the Army and Navy for special consideration in the negotiation of defense contracts. Odlum had already certified three communities, making ten in all with total employment of 120,000. Many others are expected to follow. Unemployment in some runs as high as 60 percent.

Because the law does not allow the Census Bureau to disclose certain facts, Odlum has difficulty getting information. Congress has delayed for weeks an amendment to relieve this situation. Fifty-six companies, which hold 90 percent in dollars of all defense contracts, have promised to cooperate.

Tour to Show Subcontracting

Beginning Nov. 1, three special trains will tour the country with exhibits showing manufacturers what and how to subcontract. Odlum estimates that 30,000 manufacturers will come aboard.

Army has awarded a $12,000,000 contract for .50 caliber anti-aircraft gun mounts to three household washer and ironer manufacturers, who will subcontract to 31 other companies in the same industry. This is the result of the first industry-wide certification for arms orders. All previous certifications were for communities only.

Meanwhile, it is generally admitted that subcontracting will slow down production for a short time. On just how much it will slow down, there is no agreement. Brig. Gen. Harry K. Rutherford, executive officer to the Undersecretary of War, warns Congress to go easy on spreading the work.

Machinery Shipments Climb 55 Per Cent to $45,163,329

WASHINGTON—August export of machinery, amounting to $45,163,329, were 55 per cent above shipments in July. July exports totaled $29,002.895. All categories advanced, with metal working machinery climbing from $11,506,002 to $20,699,908. Electrical machinery and apparatus climbed about $4,000,000, while mining, well and pumping machinery was nearly doubled from $2,961,543 to $5,715,118.

Shipments in August, 1940 were $14,475,608. Lathe exports this August amounted to $3,544,163, compared with $1,730,327 in July.

Some of the increase was due to shipments to the Russians, who want to tool up their armament industries east of the Urals, out of reach of the German armies. Britain received increased machinery shipments as did South American countries. The latter are attempting to make a deal for more machinery in return for raw materials.

Exports of Machinery During August, 1941

	August 1941	July 1941	August 1940
Electrical machinery and apparatus	$12,165,646	$8,618,728	$9,688,513
Power-generating machinery, except electric and automotive	3,081,224	2,625,982	1,462,055
Construction and conveying machinery	3,502,433	3,290,620	2,821,332
Mining, well and pumping machinery	5,715,118	2,961,543	4,144,971
Power-driven metal-working machinery	19,256,663	10,559,688	21,420,050
Other metal-working machinery	1,442,245	946,314	938,687

Metal-Working Machinery

Engine lathes	1,323,126	440,533	1,024,332
Turret lathes	1,266,145	872,880	1,326,523
Other lathes	954,912	416,914	1,457,000
Vertical boring mills and chucking machines	776,921	1,054,917	1,333,474
Thread cutting and automatic screw machines	1,313,394	769,433	1,377,950
Knee and column type milling machines	1,382,344	446,744	756,859
Other milling machines	2,769,346	1,287,859	2,107,320
Gear cutting machines	220,943	152,903	836,626
Vertical drilling machines	318,982	165,223	369,218
Radial drilling machines	132,111	25,075	230,760
Other drilling machines	1,178,753	338,466	318,015
Planers and shapers	392,666	111,055	564,407
Surface grinding machines	497,003	314,164	713,839
External cylindrical grinding machines	584,554	123,544	579,583
Internal grinding machines	168,880	129,390	924,321
Tool grinding, cutter grinding and universal grinding machines	595,788	307,372	718,869
Other metal grinding machines and parts	552,805	294,466	1,567,809
Sheet and plate metal-working machines and parts	1,558,422	650,128	764,546
Forging machinery and parts	979,475	719,161	979,220
Rolling-mill machinery and parts	543,558	456,542	1,175,648
Molding machines	29,711	21,633	39,616
Other foundry equipment parts	204,896	124,235	165,777
Other power-driven metal-working machinery and parts	1,509,115	1,005,783	2,083,228
Pneumatic portable tools	91,028	121,287	117,693
Other portable and hand or foot-operated metal-working machines and parts	164,681	155,486	197,447
Chucks for machine tools	79,457	74,352	56,254
Milling cutters, machine-operated threading dies and taps, and similar machine-operated metal cutting tools	666,770	246,780	197,344
Other metal-working machine tools and parts	440,309	348,409	369,949

DEFENSE PRODUCTION IS THEME OF METAL SHOW

Army announces M-4 tank with 350-deg. revolving turret and cast-steel armor. Electrical experts say more welding will increase plane production 30 per cent. Exhibits emphasize U. S. war effort

PHILADELPHIA—Accelerated production and fabrication of metals and metal products was the theme of the National Metal Congress and Exposition held here October 20-24. Nearly 35,000 members and guests of the American Society for Metals, American Welding Society, Wire Association and American Institute of Mining and Metallurgical Engineers attended the Metal Show and technical sessions where 150 papers were presented.

Outstanding among the 350 exhibits, illustrating the tenor of the times, were guns, shells, bombs, tanks, scout cars, aircraft parts and naval equipment, as well as industrial equipment for their production. An interesting display included a corrugated steel air-raid shelter by the American Rolling Mill Company, wherein auditory effects were produced to simulate actual air-raid conditions. Eleven such shelters have been installed at naval stations in recent months. Many of the exhibits demonstrated production, heat-treating and testing of newly designed parts for ordnance equipment.

Production of tanks was emphasized by Major General Jacob L. Devens, commanding general of the U. S. armored force. He announced that an improved medium tank known as the M-4, which is designed with a 5-ton 360-deg. revolving turret, will replace the present M-3 tank. The new tank will roll off assembly lines in two or three months. In addition, he reported, a 10½-ton tank has been designed by the Armored Tank Corp. for transport by plane; its speed will exceed that attainable by present armored models.

General Devens also stated tank production will be speeded by use of cast-steel armor plate. General Steel Castings Corp. will make some of it in a new $14,000,000 plant at Granite City, Ill. Other companies involved are Continental Roll & Steel Foundry Co. with a new $3,283,000 plant, American Steel Foundries which is building a $10,000,000 plant, and Symington Gould with a new $1,250,000 plant. Tank production is rated at $25,000,000 monthly at present, but by middle of 1942 it will rise to $84,000,000 monthly.

James F. Lincoln, President, Lincoln Electric Co., stated the adoption of welding in the fabrication of tanks would speed their production, decrease weight, increase effectiveness, and provide more fire power. Mr. Lincoln criticized officials for lack of foresight in not applying welding to tank construction, even though some effort had been made in that direction.

Welding in the construction of planes was emphasized at the technical sessions. Frank M. Smith, Manager, Stout Engineering Laboratories, Dearborn, Mich., described an all-welded stainless steel plane, stating "It took one-fifth the time to build compared with a riveted plane." He reported spotwelding was done with current up to 100,000 amp., and with sheets clamped under 1,000 lb. per sq. in. pressure. By intensifying welding of stainless and aluminum in plane construction, potential aircraft production could be increased 30 percent, according to Paul H. Merriman, Electrical Engineer, Glenn L. Martin Co.

Copper Restriction Minimized

The probable effect of the government's new order forbidding the use of copper in non-defense building construction after November 1, except for wiring, and virtually prohibiting its use next year in the manufacture of more than 100 household articles, was minimized by Ernest E. Thum, Editor, *Metal Progress*, at one of the ASM sessions. He reported that according to the government's own estimate there would remain 350,000 tons of copper next year

At the Metal Show—*T. D. Parker, metallurgical engineer, and C. M. Loeb, Jr., vice-president Climax-Molybdenum Corp., left and right, corral Howard L. Miller, Republic Steel Corp., in their booth*

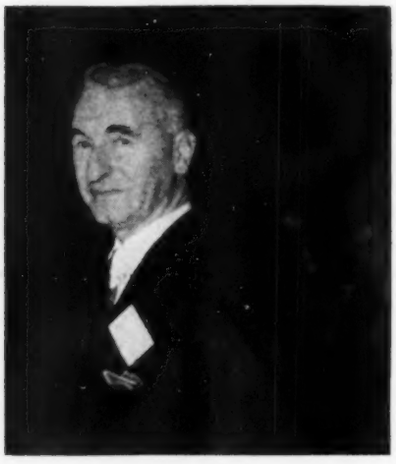
At Ajax' Booth—*R. N. Blakeslee, vice-president, Ajax Electrothermic Corp., center, talks with W. P. Morgan, de Laval Steam Turbine Co., left, and H. L. Edsall, Ajax' advertising manager*

Alcoa Experts—*Left to right: H. J. Rowe, Castings Division; H. C. Skidmore, machining expert; J. C. Smith, American Magnesium Corp.; G. N. Rogerson, welding engineer; and A. H. Woollen, engineer, Development Division, were among those present to assist in problems involved in fabrication of aluminum and magnesium parts*

after 1,300,000 tons had been allocated for defense and essential non-defense needs. The output of copper in 1932, 1933 and 1934, he recalled, was 200,000 tons.

Highlights of the Show

Almost every exhibit was designed to demonstrate each company's participation in the national defense program. In many instances, ordnance items were on display and photographs were exhibited showing installations of heat-treating and welding equipment in defense plants. For instance, the Great Lakes Steel Corporation, had in its space an M-3 tank manufactured by the Baldwin Locomotive Works. In addition, this company presented for the first time the new N-A-X 9100 series of low-alloy steels.



P. C. Osterman, vice-president, American Gas Furnace Co., showed a new full-muffle furnace with reciprocating feed

Almost all the space occupied by the Republic Steel Corp., was given over to a display of ordnance items in which its products have been incorporated. Among the items displayed were naval guns, a Sperry bomb sight, aircraft engines including the largest Allison engine which develops more than 2,000 hp., shells, bombs, and machine guns.

Laboratory methods for testing steels were the main feature of the Bethlehem Steel Company exhibit. A complete spectrographic laboratory was in operation and lecturers described how analyses of steel can be made quickly and accurately by this method.

Bridgeport Brass Company exhibited for the first time a duplex composite tubing particularly useful in oil refineries and process industries where heat-exchanger tubes fail rapidly from corrosion when corrosive action on the outside of the tube is different than that on the inside. By making separate tubes of the best metal or alloy to resist the two distinct corrosion problems, and by combining them in a duplex tube, it has been possible to overcome excessive tube failures.

Since the heat-treatment of many ordnance items involves problems not usually encountered in the manufacture of peace-time products, special emphasis was given to these problems by all exhibitors of heat-treatment and temperature-control equipment. Because a majority of the furnaces recently developed and installed for ordnance work are of large size, most furnace manufacturers were limited to a display of photographs of such installations; however, motion pictures were also used to good advantage for this and similar purposes. A furnace involving a new method of insuring uniform heating of cylindrical or rollable objects was exhibited by Lee Wilson Sales Corp. This furnace incorporates several revolving radiant tubes along which parts to be heated are fed through the furnace. This unit is used in the heating of brass slugs for extrusion, the heating of steel shell bodies, piston pins and similar parts.

Internally heated Ajax-Hultgren electric salt-bath heat-treating furnaces for molybdenum high-speed steel, together with a novel development for combination brazing and carburizing simultaneously was shown by Ajax Electric Co. In the same booth were displayed Ajax-Northrup high-frequency induction melting furnaces for high-grade steel alloys and centrifugal castings, together with high-frequency induction heaters for hot forming, brazing and hardening a wide range of parts. These induction units are manufactured by Ajax Electrothermic Corp.

Malcolm F. Judkins, chief engineer, Firthite Division, Firth-Sterling Steel Co., was kept busy discussing machining problems

Among the many interesting temperature control and recording instruments exhibited by the various manufacturers, mention should be made of the new continuous balance circular chart potentiometer made by Brown Instrument Co. This instrument employs a "continuous balance" unit in its operating mechanism.

Of particular interest were the recently improved spotwelding units for high-speed production of aircraft subassemblies on display by Sciaky Corp. and Taylor-Winfield Corp. Such units now are widely used by manufacturers of planes and their sub-contractors.

One of the major problems involved in the welding of aluminum is cleaning the surface prior to welding. Oakite Products, Inc., exhibited a cleaner that does this without affecting the aluminum surfaces, and which makes possible the production of more welds before cleaning anodes. A better bond also is obtained. Another cleaning solution was exhibited by this company for the removal of anodizing from racks, hooks and rejected parts.

WATCHING WASHINGTON

Nelson wants production doubled in 1942, as rumors led to wild predictions of quadrupled output. Government may contract for entire capacity of company or industry. Bill permits seizures

By BLAINE STUBBLEFIELD

WASHINGTON — "Shoot the works" was no mere exuberant cheer, coming as it did a few days ago from Donald Nelson, the king-pin of the U. S. production drive against the Axis. Windy stories of quadrupled munitions output engaged Washington's attention last fortnight. Wise men pared them down to the core and took what was left with several grains of salt. With all expedients wide open on copper, aluminum, and some other materials, Paul Bunyan projects cannot be carried out.

But, big things are cooking, Mr. Nelson was no party to the tall tales, but he did inspire them. OPM wants a 50% increase in the 1942 program. Nelson wants to double present output. He feels that it is better to stand up and slug with Hitler for a short time, than to spar with him for years.

It is certain that Mr. Roosevelt is whipping up nothing *smaller* than Nelson's desire. They laughed when he proposed 50,000 airplanes a year. Now we've got to a point from which that goal looks easy; FDR is the kind of man who might remember.

Open Orders May Come

Don't be surprised if you hear something about "open orders" pretty soon. An open order is one under which the Government agrees to buy all of a given item that a company, or an industry, can turn out. The main object of such a scheme would be to divert manufacturers' attention from setting up the latest fancy facilities, to the immediate turning out of the product. It would also encourage them to do more subcontracting. There is a rumor a-foot in Washington that this scheme is being considered for the procurement of tanks. When this writer questioned OPM as to the truth of it, he was told only that "It sounds like a good idea."

Bill Halts Hoarding

The "Draft Property" bill became a law after long delay. One purpose of this law is to empower OPM to take possession of essential materials which presumably are being hoarded or held in inventory by private concerns.

OPM instituted an inventory survey but did not reveal the results. An inventory control plan has long been in the works, and a freeze order to stop any movement of essential materials, especially metals, has been drafted.

But it appears now that the very existence of the draft property law may have gone a long way toward remedying whatever evils existed. OPM officials told AMERICAN MACHINIST that they expect most metals supplies to be properly used in defense orders, and that few seizures will be necessary.

Ford, Willys Complete Deal

Ford Motor Co. and the Willys-Overland Motors, Inc., have completed a deal, approved by the War Department, under which the two concerns will manufacture identical models of the Army's ¼-ton 4 x 4 (drive on four and steer on four wheels) reconaissance car, known as the "jeep." This is the first such arrangement between two auto manufacturers since the World War, although such an interchange is already working in the aircraft industry, between Boeing, Vega, Douglas and others.

Under Secretary of War Robert P. Patterson commended the manufacturers on their cooperation, and said that the output of jeeps would be more than doubled. But behind the scene, all had not been smooth running. The design to be jointly built, according to automotive specialists in Washington, is the Willys design. But, although the Army is reported to have admitted that Willys produced the best car, the Company had to fight to keep the Army from throwing it out of the picture in favor of Ford, with his greater production facilities.

The jeep program started with Ford, Willys, and Bantam, who are said *to have designed around different engines.*

Word reaches Washington that the Bantam company is out of the jeep picture. Main advantage of the Ford-Willys deal is vast productive capacity of Ford, and a single parts maintenance system for the two.

"Two Prices" Will Increase Supply

A "two price" copper plan is being worked out by SPAB, Henderson's OPA and the Treasury. Purpose is to increase the domestic production of copper by making it profitable to work deposits that cannot be mined at a profit under the present 12c ceiling, and to create jobs for men displaced by industrial priorities on materials.

One official said recently that the two price system may be extended to cover the production of other scarce materials.

MORE MULTIPLE SHIFTS

WASHINGTON—Defense officials are deeply disturbed over the failure of defense industry in general to go onto real multiple shift operation. Most second shifts, it is felt, are much too small in relation to the first shift, and the adequate third shift is the rare exception. Only one airplane manufacturer in the country, for instance, has a third shift working as many as 17 per cent of total payroll. Shortage of tools is seen as the chief limit on output, and to work defense tools some 50 hours a week is thought ridiculous. The administration wants to push tool utilization up to something like 100 hours a week. Conferences are being held at which individual firms are confronted with the figures on their machine utilization and challenged to explain why they aren't doing better.

Meanwhile, Henderson has amended the zinc scrap price schedule, providing for increases in scrap and secondary slabs, a shipping point basis for scrap prices and premiums for shipments in quantity effective Oct. 17.

Leading zinc producers increased prices 1c a pound to a basis of 8.25c for prime western grade, with the silent approval of OPA.

Henderson announced that OPA would permit importation of iron and steel scrap from foreign sources by steel plants and foundries under certain conditions. Buyers must apply for permission.

Conservation Reorganized

A Bureau of Industrial Conservation, under the direction of Lessing J. Rosenwald, former chairman of the board of Sears Roebuck, has been organized by OPM. BIC wraps up all the other agencies that were engaged in conservation and aims to save and salvage every possible pound of material now being wasted. Contacts with industry will be through the new Engineers Defense Board, of which Robert E. McConnell, a mining and metallurgical engineer already advising OPM on conservation, will be chairman. You will get salvage and conservation suggestions, in due time, from EDB.

Hurry Ships

Because Anglo-American ship shortage is urgent right now the Maritime Commission has organized a hurry-up program of 127 vessels of special types, entirely apart from its regular schedule of C and E ships. The foremost cause

of the serious cargo space predicament was the loan of some 80 oil tankers to the British.

To meet that depletion, the Commission immediately placed contracts for 136 large oil tankers. But that was not enough; all sorts of tonnage shortages are slowing many phases of the defense job.

So the Commission is arranging for 16 small diesel coastal type tankers, 25 seagoing geared-diesel tugs, 26 diesel harbor tugs, 45 small cargo ships of British design known as "coasters" and 15 concrete bulk-cargo barges.

Most interesting technical feature is use of diesel-electric drive on some, which is heavier and costs more, but gets around slower production of gears. Steam is not used because the emergency ship program is taxing capacity of reciprocating engine production. Some of the 127-ship deal is merely a hurry-up on contracts already in the works. Most of it, however, is new projects.

Plate situation, as far as shipbuilding is concerned, is much easier. If OPM planned expansion works out, there will be sufficient supply to meet the needs of the program as it nears top speed.

Full Freezing of Prices, Wages Adopted by Canada

MONTREAL—Most Canadians were surprised when Canada recently went all the way in direct action to prevent inflation. As predicted in AMERICAN MACHINIST (Vol. 85, p. 1066f), all wage rates and living costs were frozen at current levels. From Nov. 17, prices are pinned at the peaks prevailing between Sept. 15 and Oct. 11. Basic wage rates are not to exceed present levels but must be at least equal to the 1926-29 average.

This rule has been applied for some time in war plants, where cost of living bonuses (based on increases on the government living cost index) have replaced wage increases. Bonus system is extended to non-military plants, with the result that employers must pay employees $3.47 more weekly. Wages will be policied by the War Labor Board.

Prices will be watched by the Wartime Prices & Trades Board, under the chairmanship of Hector B. McKinnon. Curbs on installment buying preceded wage and price freezing. Payments must be completed within 12 months and minimum down payment for automobiles is 50 per cent, for other goods one-third. As auto production is limited, little effect is expected, but sales of luxury items undoubtedly will be reduced.

Over and above regular schedules, Canada will produce 100 tanks for Russia before the end of this year. Aluminum has already been shipped to the Soviet for use in airplane construction. Private transactions have included other items.

Training Methods, War Materiel Production And Post-War Trends Discussed by Engineers

LOUISVILLE—Motion pictures are now being released by the U. S. Office of Education as an aid in training machine operators in defense plants. This announcement was made in a paper by Floyde E. Brooker, senior specialist in visual aids, defense training, Office of Education, at the fall meeting of the American Society of Mechanical Engineers, October 13-15. The pictures are on single reels, 16-mm., 400 to 900 ft. long. Each deals specifically with one particular job on a machine tool, and that job is described in every detail including set-up, selection of feeds and speeds, and operating technique.

The value of the pictures is enhanced by animation applied to preliminary studies of the blueprint and the piece to be machined, to setting up the job in the machine, to tool setups and to selection of feeds and speeds. It was announced that 20 pictures are now ready for distribution to schools training machine operators. They will be sold outright to the schools for $8.47 per 400-ft. reel. Castle Films, New York, N. Y., has the distributing contract. Before the end of the year, Mr. Brooker reported, an additional 30 films will be ready.

Post War Events Forecast

Walter White, Department of Commerce, forecast industrial events following the present European war. "The most serious problem," he stated, "will come after this nation's military effort has been terminated and vast productive capacities are left without demand.

"How will we then keep men employed and sustain purchasing power in converting military production to civilian needs?" he asked. "If management fails to answer this problem," he added, "public agencies will take over those functions of production and distribution necessary to provide our citizens with jobs and goods. After the war," he forecast, "profits will be limited and prices fixed. Management will be closely supervised as to production. Organized labor will become stronger and demand a voice in management. Investors and management both must adjust themselves to lower standards of return. The excess profits taxes to be expected within the next year will remain in force. Companies will be required to conform to new standards of social responsibilities.

Better Days May Come

"If the reforms which can be foreseen are not carried too far," he concluded, "if our business statesmanship can adjust itself to the new order without cracking, and if our political leadership really wants to preserve a modified private enterprise system, then we may look forward to better days." He urged business men to assume a more positive attitude toward legislation affecting their economy. "The advocates of the private enterprise system either do not think that its defense is necessary," he said, "or they seem to lack the initiative to organize for political action."

Other features of the ASME meeting were papers dealing with production of equipment for our defense effort. Albert B. Cudibec and Erwin Loewy, Loewy Engineering Co., New York, N. Y., described modern methods of shell manufacture, including descriptions of the Baldwin-Omes, Witter, upset and Loewy shell forging methods. They described a British method of drawing seamless steel bodies for torpedoes. Induction heating as applied to production of centrifugal gun castings, to forging, nosing, brazing and hardening of projectiles, to surface hardening parts of war machines and to the manufacture of such parts as bearings, tools and dies was outlined by Frank T. Chesnut, Ajax Electrothermic Corp., Trenton, N. J.

Cemented-Carbide Tools Used

Malcolm F. Judkins, Firthite Division, Firth-Sterling Steel Co., McKeesport, Pa., told of the application of cemented-carbide tools in the production of shell. He surveyed present production methods and future trends.

As an example of how industry can apply itself to the production of war material, W. D. Bearce, General Electric Co., Erie, Pa., related his company's experience in the production of 75-mm. pack howitzers. After describing the manufacturing of these guns, details of which have been published in AMERICAN MACHINIST (Vol. 85, page 651), he stated that General Electric, like other contractors, found that the work was not as difficult as anticipated, because the problems involved could be and were being overcome by a sound mechanical engineering approach.

ASSIGN TANK PRIORITY

WASHINGTON—A series of priority orders—P-26-a-b-c-d, assigning a rating of A-1-d to delivery of materials and parts for 37 mm. and 75 mm. guns and mounts, and gasoline and diesel engines used in medium tanks, has been complemented with Order P-26-e. It affects 26 additional prime contractors who did not receive benefit of earlier blanket ratings. Also, Order P-25-e extends a rating of A-1-f to the producers of light tanks, covering the same items as for medium tanks, except the guns are .30 calibers and 37 mm.

DPC Finances Steel Capacity Increases; More Loans Coming

WASHINGTON—Following up SPAB's recommendation of 10,000,000 tons additional steel capacity, the Defense Plant Corp. has agreed to finance construction of new steel mills and additional "scrambled" facilities at existing mills. Total cost will be $62,343,500.

Officials of RFC, parent organization of DPC, told AMERICAN MACHINIST that it is reasonable to expect more authorizations until the ten million-ton capacity figure is reached. Current expansions provide for 1,332,000 tons of pig iron, 1,194,000 tons of by-product coke, 600,000 tons of synthetic scrap, 180,000 tons of open hearth steel and 361,200 tons of alloy steel.

Raise Alloy and Stainless Ingots

Of special interest is Republic Steel's authorization to construct facilities to produce 318,000 tons annually of electric alloy and stainless steel ingot for aircraft forgings and for tank armor plate. An increase of 1,000,000 tons annually of this type is urgently needed, says OPM.

Most important is Bethlehem Steel's $55,777,000 agreement, providing: three 1200-ton blast furnaces at Lackawanna, Sparrows Point and Bethlehem; additional coking facilities at Steelton, Sparrows Point and Lackawanna; $1,400,000 open hearth furnace at Sparrows Point (three company-financed open hearths with annual capacity of 552,000 tons are being completed at Bethlehem); and a 132-in. plate mill at Sparrows Point.

American Rolling Mill will erect one Bessemer converter at Ashland to make 600,000 tons of synthetic scrap annually; and three small electric furnaces at Middletown, Ohio, with an annual capacity of 43,200 tons alloy ingots.

DPC had already made a separate $58,312,000 agreement with Republic for construction of four blast furnaces, two at Cleveland and one at Youngstown and another at Gadsen, Ala., together with coke oven facilities at Warren, Ohio, and ore mining equipment at Port Henry, N. Y.

MANY CARBINES REQUIRED

WASHINGTON — Manufacturers of service pistols could retool and build the new carbines which the Army has decided to use in place of pistols, an Ordnance Department expert told AMERICAN MACHINIST. As 973 of the 1,181 men in an infantry regiment who carried pistols will be rearmed with carbines, it will be a big job. The Army selected a design submitted by Winchester. It weighs 4½ lbs. less than the Garand and is 7½ in. shorter. Reason for the switch is to increase the offensive hitting power of troops. The pistol was suitable only for point blank, defensive shooting. The carbine ranks next to the rifle in effectiveness.

Tooth Strength Subject of All-Day Symposium At Gear Meeting; Technical Affairs Stressed

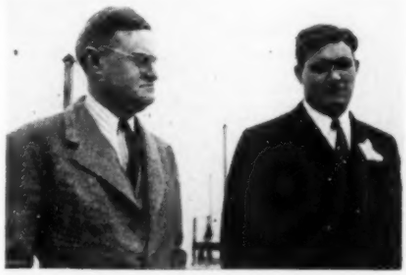
CHICAGO—Work was the keynote of the 24th semiannual meeting of the American Gear Manufacturers Association held last week. Most of the member companies are busy on defense orders; consequently emphasis on technical and business affairs of the association left little time for recreation. Progress in the association's activities and plans now under way were presented in an opening address by President W. P. Schmitter, chief engineer, the Falk Corp.

Outstanding in the technical sessions was an all-day symposium on gear tooth strength. A. H. Candee, Gleason Works, led off with a summary of strength determination by the flexure theory, advanced originally by Wilfred Lewis and since used in many forms. A paper by T. J. Dolan, assistant professor and E. L. Broghamer, associate, University of Illinois, showed how the study of photo elasticity is used to determine factors of stress concentration which may be applied directly to gear design.

Committees Report Results

Mr. Candee also contributed a paper on "Geometrical Determination of Tooth Form Factors" in which he discussed both calculated and graphical solutions. J. O. Almen, General Motors Corp., told of "Facts and Fallacies of Stress Determination" in an address which dealt largely with the fatigue failure of gear teeth.

Technical advances by the Association were also reflected in the work of the committees. Chairmen reporting considerable new data in their respective fields were E. J. Wellauer, Falk Corp., who proposed a basis for a recommended practice on steel gear materials; H. A. McConville, General Electric Co., who gave a report on extreme pressure lubricants; Dr. Stewart Way, Westinghouse Electric & Mfg. Co., who discussed recent gear and roller wear tests, principally as to his findings on gear tooth pitting; G. P. Maurer, Falk Corp., who described factors to be considered in a proposed practice recommendation on sound testing methods; and L. D. Martin, Eastman Kodak Co., who submitted a detailed report on clearance for fine pitch gears.



Irwin Koenig, Reliance Electric Co., and H. A. Brennholz, Fafnir Bearing Co., discuss gears at semi-annual convention

C. F. Pittman and P. A. McTerney, General Electric Co., in Chicago for A.G.M.A. meeting

Recommended Practices Released

In addition the A.G.M.A. executive committee voted to release to industry four recommended practices which had previously been approved. These are: (1) Data Sheet on Spiral Bevel Gear Axial Thrust, (2) Straight Bevel Gear Systems, (3) Adjustment of Bevel Gears in Assembly, and (4) Inspection and Tolerances for Gears. The first three projects were developed by the Bevel Gearing Committee, under the chairmanship of F. L. Knowles, Gleason Works, while the fourth is the work of the Gear Inspection Committee, headed by Granger Davenport, Gould & Eberhardt.

To conserve time, commercial sessions were run simultaneously with technical sessions on the second day of the meeting. Such topics as priorities, substitutions of materials, sales taxes and customer relations were on the program.

The closing session was devoted to the subject of "Priorities." E. H. Eidel, OPM Regional Office, described the current operation of the system.

CANADA SAVES MATERIALS

MONTREAL—As a result of a 25% cut from 1940 levels in production of washing machines, which was ordered on Oct. 1, it is estimated approximate 1942 savings in materials will be: steel (of all kinds), 1,000 tons; cast secondary aluminum, 70 tons; brass, 20 tons; sheet copper, 7 tons; iron (cast, hot rolled bar, and pipe), 850 tons; rubber (sheet, extruded, molded, and wringer roll), 70 tons; zinc, 100 tons; electric motors, 25,000; electric switches, 5,000 and gas engines, 2,200. Actually, the savings will be much more than these estimates, as 1941 production of washing machines to date has been substantially in excess of the 1940 figure.

U. S. Government Contracts Awarded to Metal-Working Firms

(Does not include contracts under $300,000)

Source	Agency	Commodity	Amount
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.	War	Steel	$354,888
Charles Engelhard, Inc., Newark, N. J.	"	Indicators	360,036
Electric Storage Battery Co., Philadelphia, Penn.	"	Batteries	475,020
Vultee Aircraft, Inc., Downey, Calif.	"	Gas tanks	490,000
Homelite Corp., Port Chester, N. Y.	"	Portable power plant units	461,400
Electric Auto Lite Co., La Crosse, Wis.	"	Gages	356,735
Diamond T Motor Car Co., Chicago, Ill.	"	Trucks, 4-ton	1,161,671
Yellow Truck & Coach Mfg. Co., Pontiac, Mich.	"	Trucks, 2½-ton	1,581,444
Diamond T. Motor Car Co., Chicago, Ill.	"	Trucks, 4-ton	923,715
Ford Motor Co., Dearborn, Mich.	"	Truck chasses	521,001
Weston Electrical Instrument Corp., Newark, N. J.	"	Instruments	1,554,435
Standard Aircraft Products Inc., Dayton, Ohio.	"	Thermostats	586,380
Excel-Foundry & Machine Co., Fall River, Mass.	"	Fuzes	2,494,000
Parish Pressed Steel Co., Reading, Pa.	"	Gun Carriages	2,394,697
Heald Machine Co., Worcester, Mass.	"	Boring, grinding machines	993,990
Hamilton Watch Co., Lancaster, Pa.	"	Fuzes	5,720,000
York Safe & Lock Co., York, Pa.	"	Shot	1,064,000
Robertshaw Thermostat Co., Youngwood, Pa.	"	Boosters	1,720,800
General Motors Corp., Detroit, Mich.	"	Guns	27,009,376
Kelsey-Hayes Wheel Co., Detroit, Mich.	"	"	2,952,798
Atlas Ansonia Mfg. Co., New Haven, Conn.	"	Fuzes	455,500
General Electric Co., Schenectady, N. Y.	"	Turbine superchargers	26,406,000
Morse Tool Co., Detroit, Mich.	"	Cutting tools	857,451
Continental Piston Ring Co., Memphis, Tenn.	"	Projectiles	400,000
Landers, Frary & Clark, New Britain, Conn.	"	Fuzes	860,000
General Steel Castings Corp., Eddystone, Pa.	"	Gun carriages	2,600,000
McKiernan-Terry Corp., Dover, N. J.	"	Staking machines	485,330
Teletype Corp., Chicago, Ill.	"	Printers	704,653
U. S. L. Battery Corp., Long Island City, N. Y.	"	Projectiles	1,760,000
Henry Vogt Machine Co., Louisville, Ky.	"	Shell	374,000
Aluminum Goods Mfg. Co., Manitowoc, Wis.	"	Cartridge cases	470,000
The Triplett Electrical Instrument Co., Bluffton, O.	"	Test sets	445,766
Hoover Co., North Canton, Ohio.	"	Fuzes	1,984,000
Read Machinery Co., York, Pa.	"	Shell	620,775
Inland Steel Co., Chicago, Ill.	"	Steel	791,700
Zenith Radio Corp., Chicago, Ill.	"	Frequency meter sets	566,868
Harrisburg Steel Corp., Harrisburg, Pa.	"	Gas cylinders	2,951,980
Taylor-Wharton Iron & Steel Co., Easton, Pa.	"	" "	1,493,457
Stewart-Warner Corp., Chicago, Illinois.	"	Portable ground heaters	567,000
The Sparks-Withington Co., Jackson, Mich.	"	Release assemblies	503,400
General Electric Co., Schenectady, N. Y.	"	Generators, inverters	1,486,250
Ford Motor Co., Dearborn, Mich.	"	Aircraft engines, parts	182,955,559
Eugene Dietzgen Co., Chicago, Ill.	"	Compasses, dividers	354,670
P. R. Mallory & Co., Inc., Indianapolis, Ind.	"	Release assemblies	468,000
The Holtzer-Cabot Electric Co., Boston, Mass.	"	Inverters	444,830
Keystone Trailer & Equipment Co., Kansas City, Mo.	"	Trailers, dolly converters	467,729
American Type Founders, Inc., Elizabeth, N. J.	"	Guns	3,995,850
Revere Copper & Brass Inc., Baltimore, Md.	"	Cartridge brass	445,637
Studebaker Corp., South Bend, Ind.	"	Engines	74,338,783
High Standard Mfg. Co., New Haven, Conn.	"	Guns	6,755,791
Essex Specialty Co., Inc., Berkeley Heights, N. J.	"	Flares	575,400
American Brass Co., Waterbury, Conn.	"	Brass	1,044,000
General Motors Corp., Flint, Mich.	"	Trucks, 1½ ton	4,570,501
Corbitt Co., Henderson, N. C.	"	Trucks, 6-ton	787,500
Hannifin Mfg. Co., Chicago, Ill.	"	Recoil mechanisms	396,274
Florence Stove Co., Gardner, Mass.	"	Ammunition boxes	370,000
Niles-Bement-Pond Co., West Hartford, Conn.	"	Machine tools	409,158
The Fyr-Fyter Co., Dayton, Ohio.	"	Decontaminating apparatus	399,019
Blackhawk Mfg. Co., Milwaukee, Wis.	"	Jacks	554,484
Oneida Ltd., Oneida, N. Y.	"	Shackles	546,158
Bell Aircraft Corp., Buffalo, N. Y.	"	Gun mounts	522,632
H A K Products Corp., Ft. Lauderdale, Fla.	"	Shell	780,000
Oliver Farm Equipment Co., Springfield, Ohio.	"	Packing crates	804,100
Muncie Gear Works, Muncie, Ind.	"	Gun carriages	1,540,500
American Thermometer Co., St. Louis, Mo.	"	Boosters, parts	980,000
The Sparks-Withington Co., Jackson, Mich.	"	Hoists	718,648
Stedfast & Roulston Inc., Boston, Mass.	"	Boring, turning lathes	1,352,262
Simplex Wire & Cable Co., Cambridge, Mass.	Treas.	Cable	570,445
Electric Storage Battery Co., Philadelphia, Pa.	War	Batteries	475,020
Homelite Corp., Port Chester, N. Y.	"	Generators	2,141,298
The Holtzer-Cabot Electric Co., Boston, Mass.	"	Inverters	444,830
The Leece-Neville Co., Cleveland, Ohio.	"	Generators	1,704,250
Homelite Corp., Port Chester, N. Y.	"	Portable power plants	461,400
Yellow Truck & Coach Mfg. Co., Pontiac, Mich.	"	Trucks	1,027,229
The Emerson Electric Mfg. Co., St. Louis, Mo.	"	Turret assays	8,025,000
Boeing Aircraft Co., Seattle, Wash.	"	Airplanes	214,515,584
General Motors Corp., Dayton, Ohio.	"	Struts	1,174,250
Douglas Aircraft Co. Inc., Santa Monica, Calif.	"	Airplanes	21,733,093
Keystone Trailer & Equipment Co., Kansas City, Mo.	"	Trailers	467,729
Standard Aircraft Products, Inc., Dayton, Ohio.	"	Thermostats	586,380
Service Tool Engineering Co., Dayton, Ohio.	"	Sight assemblies	383,520
The Lewis Engineering Co., Naugatuck, Conn.	"	Thermometer indicators	538,480
Hickok Electric Instrument Co., Cleveland, Ohio.	"	" "	658,590
The Sparks-Withington Co., Jackson, Mich.	"	Mooring kits	522,901
Charles Engelhard, Inc., Newark, N. J.	"	Indicators	360,036
The Electric Auto-Lite Co., La Crosse, Wis.	"	Pressure gauges	356,735
Bendix Aviation Corp., Brooklyn, N. Y.	"	Transmitters	1,473,454
Muncie Gear Works, Muncie, Ind.	"	Gun carriages	807,300
General Motors Corp., Dayton, Ohio.	"	Shell	924,260
General Motors Corp., Anderson, Ind.	"	Cartridge cases	611,000
John Dunlap Co., Carnegie, Pa.	"	" "	970,000
United Steel Barrel Co., Philadelphia, Pa.	"	Drums	436,500
Sullivan Machinery Co., New York, N.Y.	"	Air compressors	348,853
General Motors Corp., Anderson, Ind.	"	Generators	627,248
Van Norman Machine Tool Co., Springfield, Mass.	"	Milling machines	744,100
Bendix Radio Corp., Baltimore, Md.	"	Transmitters	429,760
RCA Mfg. Co. Inc., Camden, N. J.	"	"	786,000
Bendix Radio Corp., Baltimore, Md.	"	Receivers	432,850
Douglas Aircraft Co. Inc., Santa Monica, Calif.	"	Airplanes	23,673,700
Link Aviation Devices, Inc., Binghamton, N. Y.	"	Trainers	12,310,930
Yellow Truck & Coach Mfg. Co., Pontiac, Mich.	"	Trucks	37,326,055

533 PLANES EXPORTED

WASHINGTON—Official figures on aircraft export for August show that 533 planes were shipped across that month, confirming AMERICAN MACHINIST's unofficial estimate. In addition, engine exports jumped to 1,071 units from less than 300 in July. This reflects the extent to which engine makers are keeping a comfortable lead over plane production.

A good chunk of the August engine exports went to China to power planes built there. The Chinese are building P-36 Curtiss pursuits and Martin 167 light bombers (both considered obsolete models here, though many of the Martins are still in service in Africa), and several Russian designs which take U.S. engines. Most of the rest went to the British, who, in August, had accumulated a considerable arrears of spare engines for planes previously delivered.

NAMES in the NEWS

George R. Auld, superintendent, Frigidaire Ordnance Plant, Dayton, Ohio, has been appointed works manager, Aero Products Division, General Motors Corp., Vandalia, Ohio. Carl N. Bogan, formerly assistant superintendent, Frigidaire Plant, Morain City, Ohio, will succeed Mr. Auld at Dayton. L. G. Hahn has been named superintendent for airplane propeller plant which Frigidaire is constructing at Morain City. Other appointments were: W. E. Kreitzer, manager of purchasing and material control, G. W. Hughes, tool supervisor, and H. A. Klepinger, chief instructor, Aero Products; J. C. Pennington, Theodore L. Pantz, and H. K. Bentz, superintendents of processing, maintenance and tools, at Ordnance, Morain City and No. 1 Frigidaire Plants respectively.

General Edward M. Shinkle, commanding the Picatinny Arsenal, Dover, N. J., will retire from active service on Jan. 31, 1942, upon reaching the statutory retirement age of 64. Detailed to the Ordnance Department in 1906, he had spent approximately all of his subsequent service in that department.

C. C. Swift, secretary and treasurer, Ohio Machine Tool Co., Kenton, Ohio, has been elected president to succeed the late Walter D. Sayle. He had held his previous position since 1911.

Harry L. Bill, formerly president and general manager, United Aircraft Products, Inc., Dayton, Ohio, has been elected vice president and general manager of the Greenfield Tap & Die Corp., Greenfield, Mass., to succeed Mr. Howard M. Hubbard, recently resigned.

Herbert A. Cohn and Walter W. Wendelken, formerly of the factory service division, Westinghouse Electric & Manufacturing Co., East Pittsburgh,

Involved in Frigidaire Plant Manager Shifts

C. N. BOGAN

G. R. AULD

L. G. HAHN

Pa., have been appointed superintendents in the building construction and maintenance department. As steam superintendent, Mr. Cohn becomes responsible for all boiler plant and heating installations. Mr. Wendelken, electrical superintendent, will supervise design and specifications.

Duane Brice has been promoted to the position of assistant treasurer, Plomb Tool Co., Los Angeles, Calif.

William A. Craig has been appointed purchasing agent, Philadelphia Plant, Link-Belt Co., succeeding the late James C. Lenahan. Mr. Craig joined Link-Belt in 1916, and had been Mr. Lenahan's assistant for many years.

J. F. Eckel has been named supervisor of the subcontracting program of General Electric Co. Formerly coordinator of manufacturing activities of the company's refrigerator department, he will supervise subcontracting and relations with subcontractors and defense officials.

Crossley W. Gale has been named assistant to the director, steel division, Washington Liaison Branch of the Canadian Department of Munitions & Supply. He was loaned to the department by the Burlington Steel Co., Ltd., F. M. Connell, president of several mining companies, was appointed deputy metals controller of the department. He had been assistant metals controller.

W. J. Greene, general sales manager, has been made vice-president in charge of sales, L. S. Starrett Co., Athol, Mass. J. R. Cullen was appointed export manager.

Walter E. Hawkinson, treasurer, Allis-Chalmers Manufacturing Co., Milwaukee, Wis., since 1936, was elected secretary-treasurer. He assumes the secretarial duties of William A. Thompson, company vice president and secretary, who recently resigned after 40 years service.

J. S. Knowlson, president and chairman of the Board of Directors, Stewart-Warner Corp., Chicago, Ill., has been appointed deputy director in charge of operations, Division of Priorities, Office of Production Management. He succeeds Thomas B. McCabe who has joined the staff of Lend-Lease Administrator Edward R. Stettinius, Jr.

W. F. Kurfess, vice-president, Joseph T. Ryerson & Son, Inc., Chicago, Ill., has been ordered to active duty in the United States Navy. He will take charge of the Steel Div., Bureau of Ships, Navy Department, in Washington.

John F. McKernan, until recently chief of equipment in the Production Division of OPM, has returned to the Western Electric Co., Kearny, N. J., as manager of defense program planning. George R. Logan, associated with Mr. McKernan in Washington and previously in Western Electric, will serve as his assistant.

R. H. Musser, for the last four years assistant district sales manager, in Chicago, has been appointed manager of the priorities department, Heppenstall Co., Pittsburgh, Pa.

Harlan H. Newell has been elected treasurer and a member of the board of directors, The Cleveland Automatic Machine Co., Cleveland, Ohio.

Bruce R. Prentice has been promoted to engineer, Aeronautics Equipment Division, Aeronautics and Marine Engineering Department, General Electric Co., Schenectady, New York. Other appointments are: Kenneth K. Bowman, assistant engineer, Aeronautics Equipment Division; Harley H. Bixler, mechanical engineer on special assignments and Laurence R. Leveen, administrative assistant, Ordnance Control Division.

Philip C. Rosenthal, formerly on the faculty of the department of metallurgy, University of Wisconsin, has joined the research staff of Battelle Memorial Institute, Columbus, Ohio, to direct investigations in metallurgy. Carl L. Wallfred, previously with the Minnesota Mining & Mfg. Co. and the A. O. Smith Corp., has been named to the technical staff, division of process-metallurgy.

W. C. Sayle, who has been connected with the Cleveland Punch & Shear Works Co., Cleveland, Ohio, for the past 30 years, has been elected to succeed his father, the late Walter D. Sayle, as president.

Fred C. Wood, newly appointed manager, Air Conditioning Department, York Ice Machinery Corp., will devote his attention to air conditioning aircraft manufacturing plants, blast

GE Subcontractor

J. F. ECKEL

Succeeds Father

W. C. SAYLE

Greenfield Officer

H. L. BILL

furnaces, industrial processing, laboratories, testing rooms and precision manufacturing, in addition to civilian air-conditioning applications.

PLANT EXPANSION

The Defense Plant Corp., subsidiary of the Reconstruction Finance Corp., has authorized the following lease agreements for plant and machinery expansion:

Allis-Chalmers Mfg. Co., Milwaukee, Wis., $9,066,964.

American Propeller Corp., Toledo, Ohio, $3,632,306.

American Welding & Mfg. Co., Warren, Ohio, $484,000.

Aviation Mfg. Corp. (Lycoming Division), Williamsport, Pa., $3,714,277.

W. F. & John Barnes Co., Rockford, Ill., $2,000,000.

Bridgeport Brass Co., Indianapolis, Ind., $820,000.

Eastern Specialty Co., Philadelphia, Pa., $100,331.25.

General Alloys Co., Boston, Mass., $91,163.

General Steel Castings Corp., Granite City, Ill., $14,000,000.

Kellett Autogiro Corp., Philadelphia, Pa., $95,957.

Pullman-Standard Car Mfg. Co., Chicago, Ill., $285,152.

The Symington-Gould Corp., Rochester, N. Y., $1,256,105.

The Wellman Bronze & Aluminum Co., Cleveland, Ohio, $194,221.

N. A. Woodworth Co., Ferndale, Mich., $592,045.

Plomb Tool Co., Los Angeles, Calif., has increased facilities to include new and modern quarters for the tool and die, polishing, maintenance, grinding and burring departments.

Reynolds Metals Co., Listerhill, Ala., are having plans drawn for their third aluminum plant which will increase their aluminum production to 160,000,000 lb. a year.

BUSINESS ITEMS

Ampco Metal, Inc., has transferred Frank A. Burnett from the Cincinnati to the Indianapolis office. E. A. Svoboda, Indianapolis, will take charge of the Cleveland office, replacing J. A. Morrison, resigned. Russell E. Campbell has joined West Coast division.

Fray Machine Tool Co., Glendale, Calif., has been purchased by a group of business men headed by James H. Richards, former general manager of the company. Mr. Richards is now president as well as general manager.

Electrical Research Products, Inc., has been merged into the parent Western Electric Co. as the Electrical Research Products Division. Foreign subsidiaries of Electrical Research will be transferred to the newly created Western Electric Export Corp. T. Kennedy Stevenson, formerly president of the subsidiary, was made a vice president of Western Electric and also will be president of the export group.

C. F. Bulotti Machinery Co., 829 Folsom St., San Francisco, Calif., has been appointed agents for Kent-Owens machines in that territory.

Chain Belt Co., Milwaukee, Wis., announces the appointment of A. W. Thomas, sales manager, construction machinery division; D. A. Kalton, assistant sales manager and A. J. Frank, assistant division manager.

General Electric Co. has consolidated the mechanical drive and turbine-generator sections of Lynn River Works and appointed J. L. Kerr manager of sales and L. D. Whitescarver general assistant. J. R. Casey replaces the latter in the field.

Jessop Steel Co., Hartford, Conn., has appointed H. F. Robertson district manager New England office and warehouse. Other changes are: J. W. Stranahan from Cleveland to Philadelphia, Paul R. Wendt from Cleveland to Toronto, H. Preston Berry from Washington, Pa., to Chicago.

Manning, Maxwell & Moore, Inc., Bridgeport, Conn., has appointed Earl C. Maund in a sales and engineering capacity at Chicago office.

Ohio Crankshaft Co., Cleveland, Ohio, has transferred Harlan A. Messner to Los Angeles, Calif., to supervise district sales and service.

Service Engineering Co., 650 Broadway, Newark, N. J., has been revived.

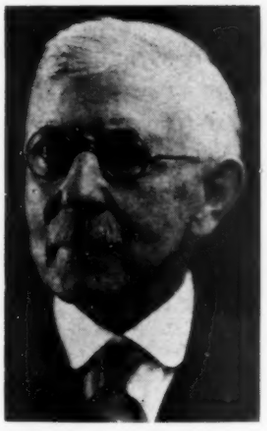
Western Tool Co. has moved to 619 W. Randolph St., Chicago, Ill.

York Ice Machinery Corp., York, Pa., has selected J. L. Rosenmiller to head the new sales department known as the accessory equipment and maintenance department. The advertising department has moved from New York, N. Y., to York, Pa.

OBITUARIES

E. Walfrid Ericsson, 68, president of the Ericsson Screw Machine Products Co., Brooklyn, died Oct. 12 at Lake Mahopac, N. Y. He had been with the National Acme Manufacturing Co. before establishing his own business in 1912.

Charles Lorenzo Clarke, 88, who retired from the General Electric Co. ten years ago, died Oct. 9 in Newton, Mass. During his association with Thomas A. Edison he designed the Jumbo dynamos and many electric generators. He was a charter member of the American Institute of Electrical Engineers.



CHARLES L. CLARKE

Gustave W. Fries, 67, founder and president, O. K. Machine Co., Fort Wayne, Ind., died recently. A native of Sweden, he had lived in Fort Wayne since 1907 and founded the company in 1917.

Harold F. McCormick, 69, chairman of the board, International Harvester Co., died Oct. 16 in Beverly Hills, Calif. A son of Cyrus Hall McCormick, who invented the reaping machine, he had been actively interested in the company since 1895. In 1902 he became vice-president, in 1906 treasurer, in 1918 president, and in September, 1935, chairman of the board. He was a trustee of the University of Chicago, the McCormick Theological Seminary, and the Chicago Orchestral Association. Noted for his interest in music, he was a member of the board of Chicago Civic Opera Co., until it collapsed, and in 1934 he helped organize the Chicago Opera Co., of which he became honorary chairman.

Albert Temple Potter, 76, an employee of E. C. Atkins & Co. 51 years and for many years manager of purchases and supplies, died Sept. 28.

O. V. Strand, of N. A. Strand & Co., Chicago, Ill., died Oct. 17.

MEETINGS

National Association of Manufacturers. Congress of American Industry, Waldorf Astoria, New York, N. Y., Dec. 1–5.

Society of Automotive Engineers. National Aircraft Production meeting. Biltmore Hotel, Los Angeles, Calif., Oct. 30-Nov. 1.

SHOP EQUIPMENT NEWS

Thompson Introduces Toolroom and Production Surface Grinder; Has Hydraulic, Hand Feeds

To fill a demand for a small, sensitive, high speed toolroom and production surface grinder, the Thompson Grinder Co., Springfield, Ohio, has developed a Type F machine. It is a sliding head model with horizontal spindle, grinding with the periphery of the wheel with reciprocating table. Both hydraulic and hand feeds to the table and wheel head are provided.

Table hand feed is automatically engaged when the hydraulic power is shut off. This feed is not gear driven, but operates on the principle of a screw drive with anti-friction nut. Thus, it is possible to position the table accurately with minimum effort. Double length box type bed houses both coolant and hydraulic systems, making the machine entirely self-contained. Transverse movement of the wheel head unit is effected through telescope pipe by hydraulic power. For dry grinding there is an accessory dust collector. Grinding wheel, 12x1/2x1¼ in. is powered by a 1½-hp. motor at 1,750 or 3,450 r.p.m.

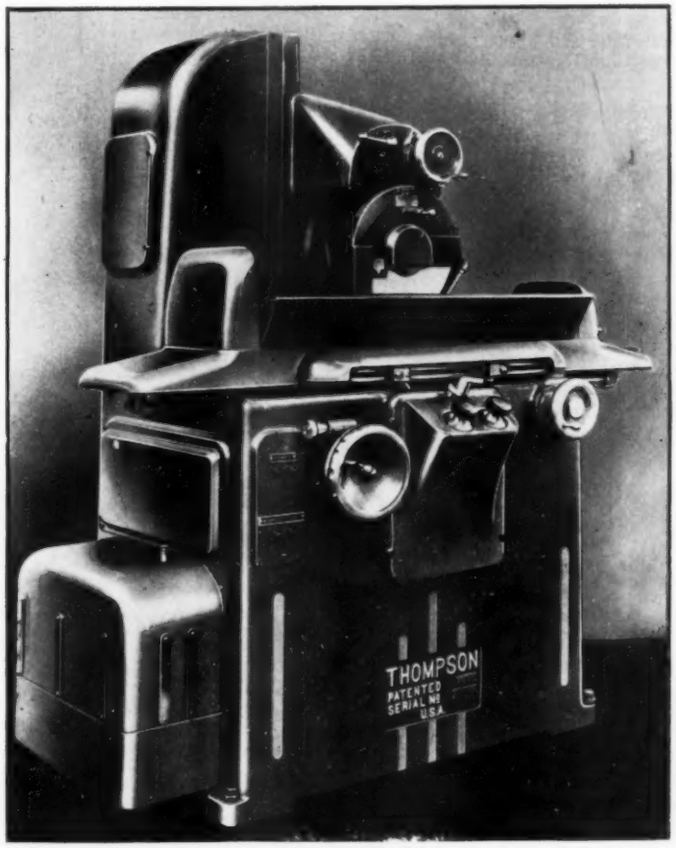
Right hand auxiliary wheel guard can be easily removed so that a table type wheel truer can be used in form grinding. The large diameter wheel holds its shape better during contour grinding than smaller wheels. Swivel or plain type vise can be used on this machine for grinding special tools. A micrometer stop can be supplied for use with elevated hand wheel. With it grinding to 0.0001 in. can be done without difficulty.

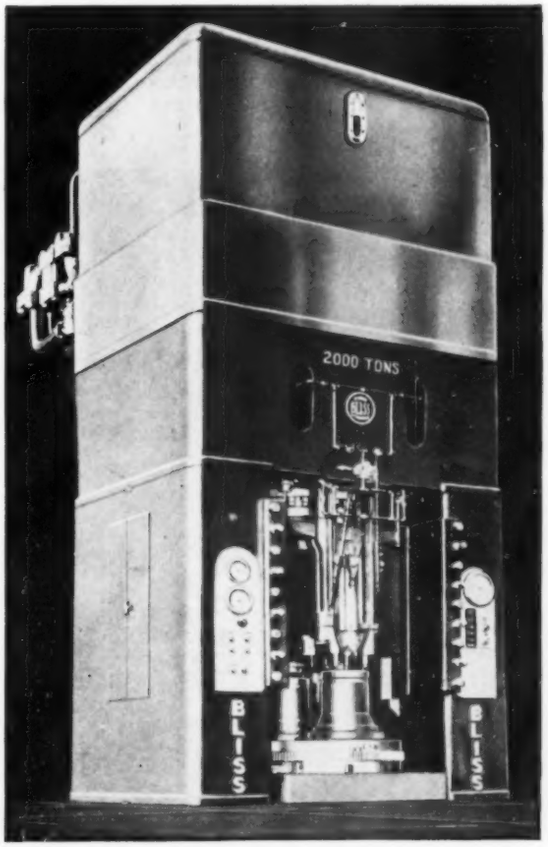
Controls are centralized on the front of the machine. Work table is 6x18 in. Maximum table movement is 20 in. and transverse movement 6 in. Hydraulic table feed is 5 to 50 ft. per min., while table under hand operation feeds at 0.2 in. per revolution of hand wheel. The machine including motors weighs 2,800 lb. and occupies a floor space 36x80 in. Table ways are pressure lubricated with filtered oil.

Hydraulic Cartridge Case Heading Presses Operate Automatically

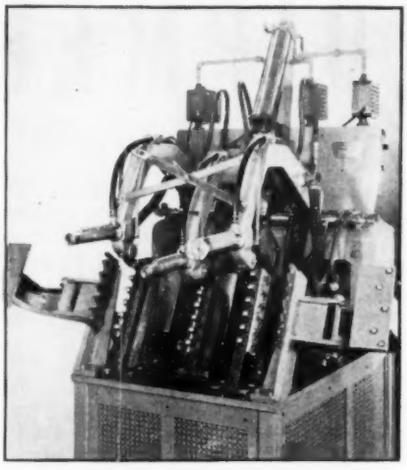
Hydraulic presses of 1,500 and 2,000 ton capacities for cartridge case heading have been added to the line manufactured by E. W. Bliss Co., 53rd St. and Second Ave., Brooklyn, N. Y. The press of four-piece frame construction is entirely self-contained. It is operated by a 75-hp. motor on the main drive and a 7½-hp. motor on the ejector drive. The latter, which is placed under the loading and unloading stations, has a capacity of 38 tons. Automatic pressing cycle is: movement of case into press, rapid descent of press, pressing, return of press to starting position, raising completed case from die by ejector and picking up case with air hoist by operator. If two pressings are required on each case, punch shifter moves into second position and press again goes through pressing cycle before ejection.

Safety interlocks are provided to insure alignment of die and punch. Operation without work in die is prevented. A production rate of 300 anti-





aircraft cases per hour can be obtained on these presses. Shock due to impact when stopping is eliminated by pneumatically operated key station lower dial equipped with hydraulic dash pots. A two-station punch holder is included with the press slide. Other models in the line include a 2,800-ton and a 3,300-ton press.



Welding Guns Locate Automatically In Assembling Units From Parts

Automatically locating welding guns for assembling units built up from a number of parts have been developed by Progressive Welder Co., 3001 E. Outer Drive, Detroit, Mich. Originally designed for spot welding grilles of automobiles, the fixture permits welds in groups at several different positions of the guns. This is accomplished by a slide with automatic indexing device to carry guns.

It is necessary only to locate the parts in the fixture over fixed electrodes, clamp them in position and press starting switch. Slide then moves to the first position and the welding points of the gun move against the work. When these welds are completed, points move out and the slide carries guns to next position. This continues until completion of the entire cycle.

Roller Grid Speeds Non-Ferrous Quenching; Heating Elements Changed Without Cooling

Non-ferrous quenching operations are speeded up by the automatic roller grid developed by the Lindberg Engineering Co., 2450 W. Hubbard St., Chicago, Ill., for use with "Cyclone" forced convection box type furnaces. Roller grid powered by an air cylinder automatically engages a carriage pushed to the work chamber by the cylinder. Carriage pulls the roller grid along the tracks from the chamber into the open where work is easily accessible and can be removed for quenching.

Grid when reloaded is automatically returned to work chamber where carriage disengages. The hand-controlled, air-operated vertical lift door then is lowered into place.

Furnace works on the cyclone principle which employs a high velocity fan forcing air under pressure over the heating elements and throughout the work chamber.

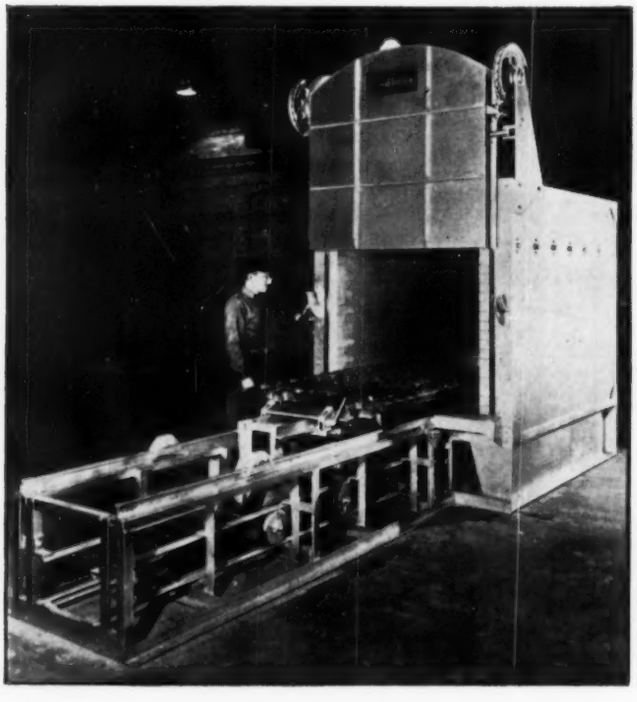
Heating is rapid and all parts of the charge are heated to exactly the same temperature. Heating elements consist of coiled nickel chromium wire situated with the fan in a separate chamber within the furnace. This permits easy replacement (10 minutes without cooling furnace) and prevents local overheating due to radiation from heat source. Five standard sizes are available with a temperature range from 200 to 1,250 F.

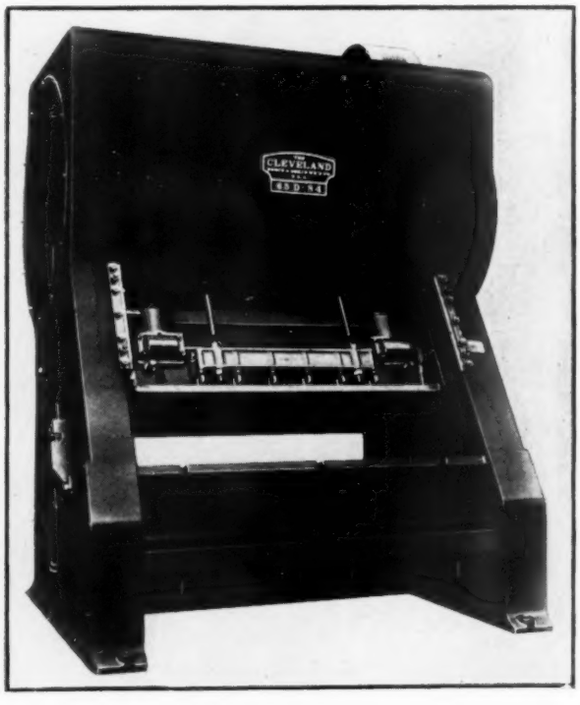
Finished Pieces From Press Discharge Into Tote Boxes

The straight-sided double crank press introduced by the Cleveland Punch & Shear Works Co., Cleveland, Ohio, is set at a permanent incline of 30 deg. for gravity discharge of finished pieces into tote boxes placed at the rear of the press. Of four-piece tie-rod construction, it is single geared and equipped with electrically controlled hydraulic friction clutch and brake.

Automatic single roll feed takes material $\frac{1}{4}$ in. thick and 2½ in. wide across the dies. Slide has a 3 in. stroke, 3½ in. adjustment and operates at the rate of 45 strokes per minute. Bed area is 30x84 in.

Capacity of the press is 150 tons. Overhanging gears and other projections have been eliminated. Slide, which may be spring or air-counter-balanced, adjusts by hand.





Hammond 10-In. Carbide Tool Grinder Combines Straight and Cup Wheel Methods; Table Tilts

A 10-in. carbide tool grinder combining facilities for straight wheel peripheral and cup wheel face grinding has been added to the line of grinders manufactured by Hammond Machinery Builders, Inc., 1618 Douglas Ave., Kalamazoo, Mich. Work tables tilt from 0 deg. (at level) to 25 deg. They slide easily to any point of adjustment on machined ways, locking in selected position.

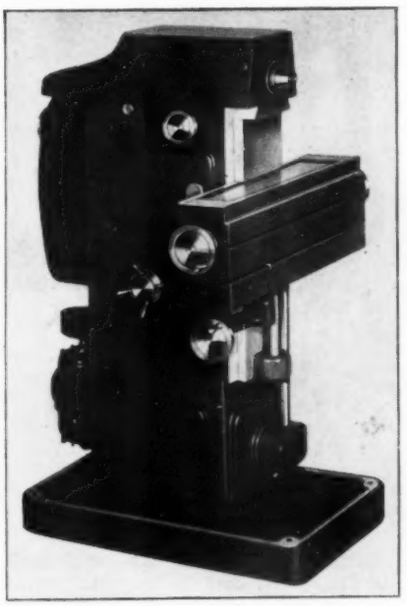
Slots accommodate the protractor angle-guide furnished, and grooves keep working surfaces free from grit and dirt which might affect accuracy. Table on the right is mounted on a heavy shaft directly over a casting which serves as a sludge pan. By releasing a simple clamp, the entire unit may be removed permitting cleaning of pan or replacing of wheels. For wet grinding with diamond cup wheel, the right side can be fitted with a reservoir mounted directly over the wheel.

Power to turn spindle at the standard rate of 2,100 r.p.m. is supplied through

adjustable V-belts by a 1-hp. motor. Frame is a heavy vibrationless casting. Height from floor to spindle center is 38 in., and the area of the base is 15x18 in.

Milling Machine Table Mounted Vertically, Takes Large Work

Vertical mounting of the carriage table on the milling machine made by Portman Machine Tool Co., 17 and 19



Portman miller showing vertical table for large work pieces

Beechwood Ave., Mt. Vernon, N. Y., permits mounting unusually large work pieces or bulky fixtures under the spindle. Pivot joint of the table elevating screw makes it possible to clamp large work that extends to the base of the machine, directly to the front of the carriage table. In addition, ram type spindle housing is movable across the face of the table, and enables operator to set machine to the work. Thus, it is not necessary to reset work for different operations.

Vertical table, 32x10½ in. pivots 180 deg. and is adjustable to 45 deg. from horizontal. A removable right-angle work table providing a horizontal surface and an adjustable arbor support head are furnished. Eight spindle speeds ranging from 90 to 1,760 r.p.m. are provided. Table feeds from ¾ to 14½ in. per minute are independent of spindle speed. Power is supplied by a 2-hp. motor. Distance from spindle zone to base is 46 in. without obstruction.

Vertical Triplex Power Pumps Made for Pressures to 9800 lb.

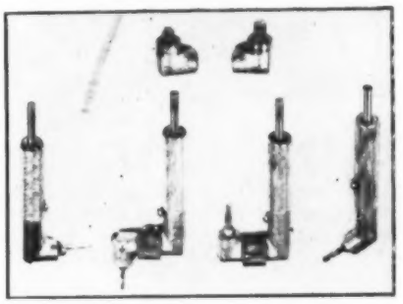
A series of high pressure vertical triplex power pumps in eight sizes for pressures to 9,800 lb. and capacities to 51 g.p.m., are being supplied by Worthington Pump & Machinery Corp., Worthington Ave., Harrison, N. J. Pumps are suitable for applications such as hydraulic presses and roll balancing in steel mills. Pump has no gears and is especially designed for use with built-in gear motors, but can be arranged for V-belt drive. Plungers are outboard. A dry joint between liquid cylinder and power frame eliminates possibility of leakage of liquid into crank case.

Tool Box Conveniently Located On Shelf Is Out of Workers Way

A convenient place for the tool box within easy reach of the worker is provided by a shelf recently designed by the Challenge Machinery Co., Grand Haven, Mich., for use on Challenge cast iron top benches. Above the bench, the shelf does not interfere with working surface but enables worker to open tool box and drawers without difficulty.

Angular Tool Attachments Solve Problem of Work in Small Spaces

To solve the problems of operation in small spaces and corners, the Invincible Tool Co., 914 Citizens Trust Bldg., Fort Wayne, Ind. has developed a set of angular tool attachments for portable drills. One tool, No. 1875, with straight or 45 deg. head is 4¼ in. long with a ⅝ in. diameter. Its holder has a capacity of 3/16 in. The other tools, Nos. 250 and 3125, are equipped

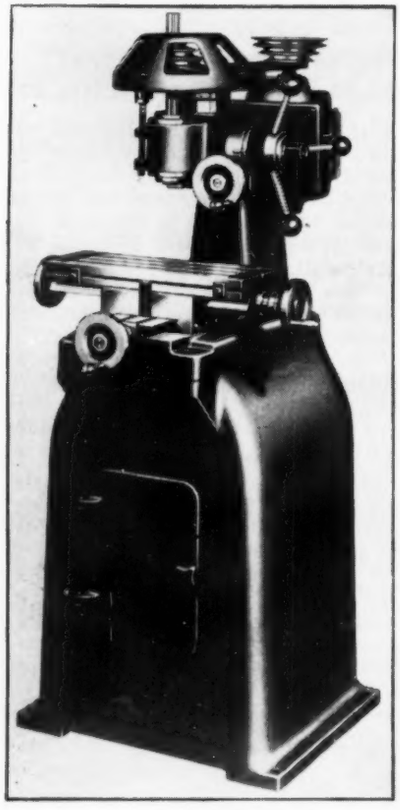


with ¾ in. chuck and 5/16 in. holder. They are 6 in. long with head diameters of 1 in. and body diameters of 1⅛ in. No. 3125 is at 90 deg. angle with main shaft. No. 250 are adjustable to any angle in the vertical plane.

Milling Machine by Granite State Manufactures Small Arms Parts

The No. 0 vertical milling machine, put out by Granite State Machine Co., Inc., 448 Silver St., Manchester, N. H., was designed for precision milling, boring, facing and routing operations in tool, die and machine shops. It is particularly useful in the manufacture of small parts for instruments, arms and munitions. Spindle is driven by a ½ hp. motor through a V-belt drive, either at speeds of 276, 547, 948, 1,292 and 2,811 r.p.m. with the 1150 r.p.m. motor or at 240, 833, 1,441, 2,433, and 4,277 with the 1,750 r.p.m. motor.

Table, 6x16 in., has a longitudinal travel of 8½ in. and a cross travel of 7 in. Spindle feed is 4 in. Spindle travel is by means of a hand wheel through worm and wheel or by means of pilot handles. The micrometer collar reads in 0.001 in. Table is provided with T-slots to take ⅜ in. T-slot bolts. It also has adjustable stops for each

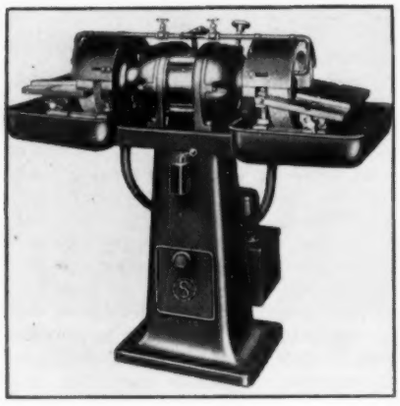


way of table travel. The bench model of the machine weighs 350 lb. and occupies an area of 11x20 in. Weight of floor model is 700 lb. and it requires a space 18x22 in.

Dry and Wet Tool Bit Grinder Manufactured in 10, 12, 14-In. Sizes

A high-speed tool bit grinder for wet and dry grinding has been announced by the Standard Electrical Tool Co., Eighth St., Cincinnati, Ohio. It is manufactured in three sizes; with 10 in. cup or steel back cylindrical wheels, driven by a 1-hp. motor; with 12-in. wheels driven by a 2-hp., 1,750 r.p.m. motor; and with 14-in. wheels powered by a 3-hp., 1,150 r.p.m. motor. Each wheel is equipped with a wet grinding attachment.

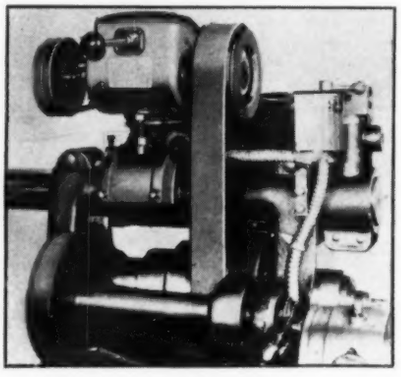
Guards are adjustable to wheel wear. Table with angular, vertical and lateral movements is grooved and has an adjustable fence for resting tools being ground. Valve on each wheel controls flow of coolant. Reversing starter permits selected rotation of wheels.

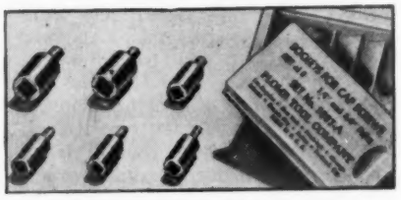


Western Improves Transmission Designed for 1 to 5-Hp. Motors

Western Manufacturing Co., 3428 Scotten Ave., Detroit, Mich., has improved and streamlined its Western Master transmission used in motorizing cone-driven machine tools. Result is a more compact unit with shifting lever moved into main body of the transmission and provision of more positive action. It is designed for use with 1 to 5-hp. motors.

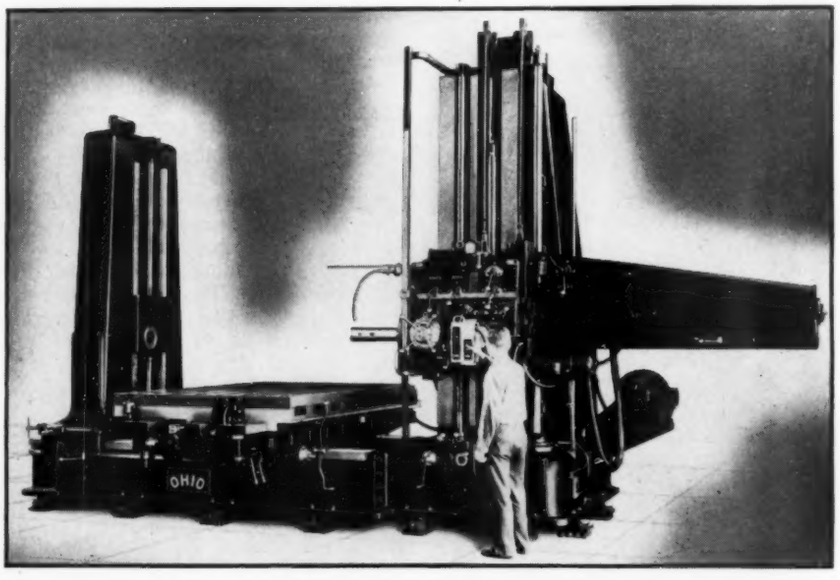
Like the former Master and the Major (for 5 to 10-hp. motors), it is adopted for all kinds of machine tools. Three mountings are offered: (1) lathe bracket, used also for motorizing automatics, bolts, Fellows gear shapers, vertical milling machines, radial drills, turret lathes and screw machines; (2) shaper bracket which is also adapted for boring mills and vertical mills; and (3) milling machine bracket.





Broken Drive Plugs Replaceable In Sockets Made by Plomb Tool

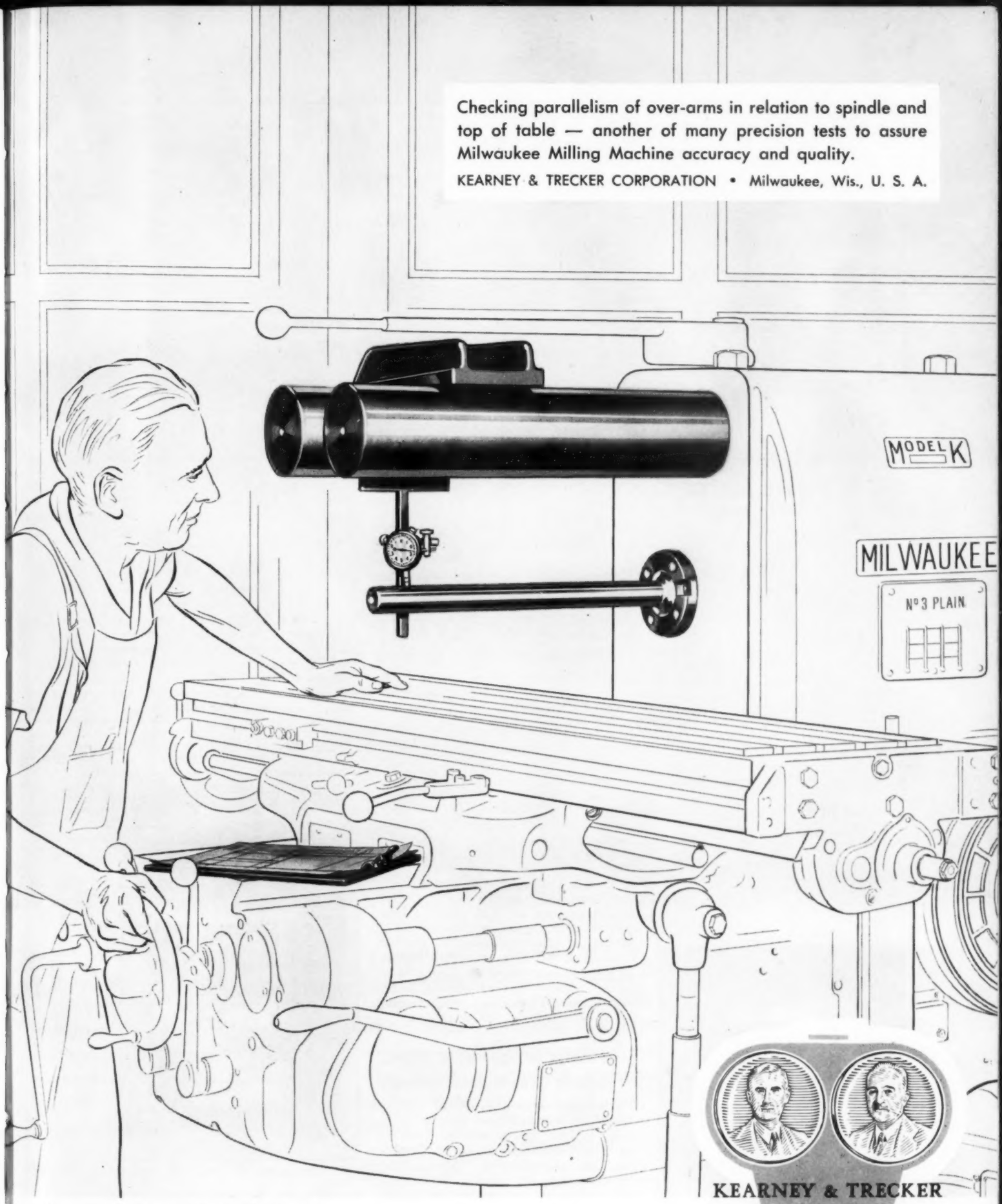
Sockets for all regular sizes of socket head cap screws and set screws have been made available in the line of hand tools manufactured by the Plomb Tool Co., 2209 Santa Fe Ave., Los Angeles, Calif. Socket sizes are from ¼ to ⅝ in. for hexagon openings from ⅛ to ⅜ in. Drive plug is made separately from the socket part and is held in position by small set screw. It, therefore, is simple to replace broken parts, thus saving the original socket part.



Ohio Adds Large Machine to Line Of Borers, Drillers, Millers

The Ohio Machine Tool Co., Kenton, Ohio, has added a large horizontal boring, drilling and milling machine to its Dreadnaught line. It has a 72x132 in. table, a 60-in. bed and from 10 to 20 ft. between face plate and bar support. The vertical travel of spindle head is 96 in. Machine has continuous spindle feed of 72 in.

The ratio between low and high spindle speeds is 1 to 190 with maximum speed of 600 r.p.m. Power rapid traverse is built in with push-button control. Multiple splined shafts with splines milled from the solid are used for all sliding gears and clutches. Spindle head carries speed and feed transmission, the loads from spindle and gearing being transferred to the column face. A similar machine is available in a floor type.



Checking parallelism of over-arms in relation to spindle and top of table — another of many precision tests to assure Milwaukee Milling Machine accuracy and quality.

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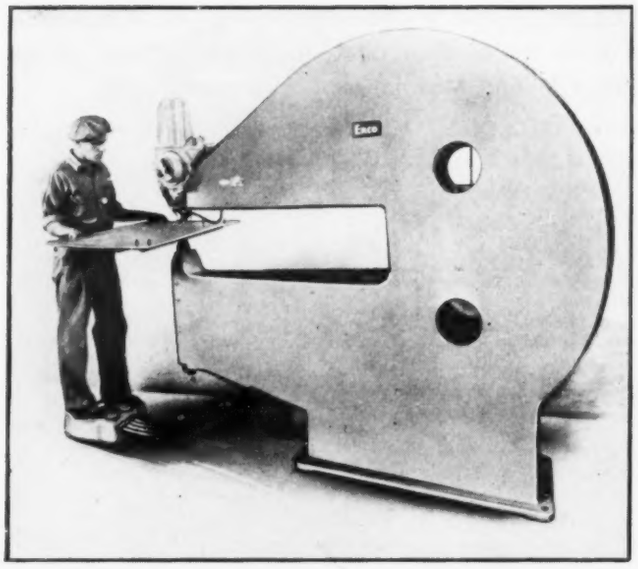
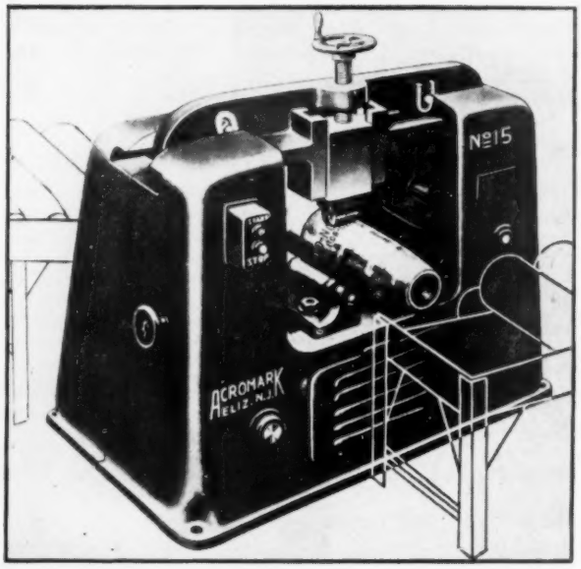




Automatic Riveter Requires No Drilling, Reaming, Countersinking

An automatic C frame punching and riveting machine with a 48-in. throat is being manufactured by Engineering and Research Corp., Riverdale, Md. All styles of solid rivets are set in one continuous operation by depressing two remote control pedals. No previous drilling, reaming, countersinking or matching of holes is necessary. Rivets up to $\frac{1}{4}$ in. in diameter can be handled by this machine.

Punching capacity is for the material having thickness similar to the diameter of the rivet, and counter-sinking capacity for material up to 75 percent of the diameter of the rivet. Pneumatic operation uses air pressures from 90 to 100 lb. per sq.in. The machine is 79 in. high, 31 in. wide and 89 in. deep. Spot light indicates where hole is to be punched.

Acromark Shell Marker Can Be Adapted for Marking Cylinders

A shell marker which can be later adapted for marking bars or small cylindrical parts of varying diameters has been developed by the Acromark Corp., 251 No. Broad St., Elizabeth, N. J. The machine, No. 15, uses an ordinary flat die or type held in heavy slide. This eliminates the necessity of expensive rotary marking wheels with segment type or roller dies. Shell is fed by hand or specially designed feed, is slid on to the ball bearing cradle roll, marked as the slide die holder passes over it and ejected onto tray or conveyor. Die holder marks a shell at each forward or backward stroke by rotating shell as it passes over it. Adjustments for various diameter shell are made by changing cradle rolls.

Bell Licenses Fabric Attaching Method Which Saves Time, Money

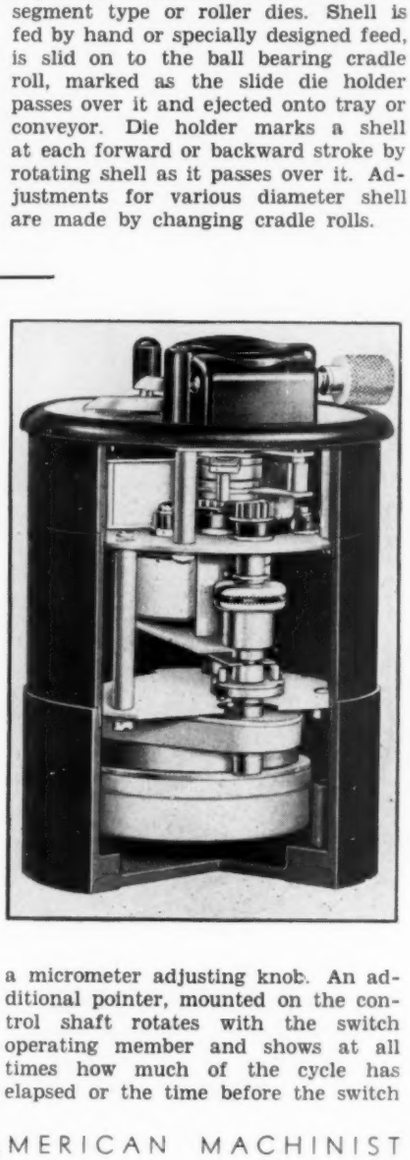
Fabric attachment to aircraft by use of a special tool which forces thin retainer strips into extrusions in the rib construction, developed by Bell Aircraft Corp., 2050 Elmwood Ave, Buffalo, N. Y., is being made available through licensing to other manufacturers. This method cuts production costs, increases speed, and provides a stronger attachment than obtained by conventional methods.

Only a small amount of pressure is required to force strips into the extrusion, but fabric is held tightly without danger of tearing. No holes are made; patches are not required over the retainer. Time studies reveal a saving of approximately 75 percent over usual stitching procedure and of 50 percent over the more recent sheet metal screw attachment systems. Furthermore, unskilled labor may safely be employed for this work.

Time Relays for Opening or Closing Electric Circuits Reset Instantly

Time relays to keep electrical circuits closed for a preset time interval or to open circuit for a selected interval have been developed by R. W. Cramer Co., Inc., Centerbrook, Conn. Type RS1C is used for closing the circuit, and type TD1C for opening the circuit. Timers have an instantaneous reset feature. Audible or visual signal circuits can be connected with them.

Settings are made by moving a pointer slowly across the dial with a micrometer adjusting knob. An additional pointer, mounted on the control shaft rotates with the switch operating member and shows at all times how much of the cycle has elapsed or the time before the switch



After the rush is over!

Typical picture in American industry *today*—a battery of Ex-Cell-O Standard Precision Boring Machines turning out various defense parts with extreme accuracy, on a high production, low unit cost basis. *Tomorrow*, these same standard Ex-Cell-O machines—each of which is built for flexible use and ease of operation in precision work—will prove profitable to their owners when the swing over to non-defense products *must* be made.

Sweet music to the ears of today's buyers of Ex-Cell-O precision machines will be the steady sound of those same machines in operation *tomorrow* . . . when world peace will bring a definite advantage to manufacturers in this country whose present equipment can be adapted to civilian needs, quickly and profitably, and still meet the new high standard of speed and accuracy in production.

Every standard Ex-Cell-O machine—for boring, for grinding threads, for other precision machining—is designed and built to do most efficiently and at low cost the extremely accurate job demanded today for defense . . . to meet these same exacting requirements that will unquestionably be essential tomorrow if profits in competitive markets are to be assured.

Wherever an Ex-Cell-O precision machine is installed today, one of the most important steps in the planning for the inevitable tomorrow is already taken.

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XLO

Precision THREAD GRINDING, BORING AND LAPPING MACHINES, TOOL GRINDERS, HYDRAULIC POWER UNITS, GRINDING SPINDLES, BROACHES, CUTTING TOOLS, DRILL JIG BUSHINGS, PARTS

"I WANT THE BEST POSSIBLE JOB— I MUST HAVE A GOOD OIL!!"

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"I'm doing a job here that must be perfect when it leaves the shop. The people who get the gears are plenty critical." These are the words of A. E. Davey, president of the Alloy Steel Gear and Pinion Company.

He says further, "I don't know everything about oil. That is why I called in the Cities Service Lubrication man. I expect him to work with my men to see that they get the lubricant best suited for the job."

A. E. Davey

Much work in this shop must meet rigid government inspection. All machines, including Gleason, Fellows Gear Shapers, Lee Bradner and Browne & Sharpe machines, are operated with Cities Service Lubricants. You, too, will find these high-quality fluids capable of doing the kind of work your customers want.

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trips. This progress pointer instantly resets with the switch arm. Synchronous motor is slow speed 450 r.p.m. self-starting type.

Switch unit is a quick-make, quick-break type with silver contacts rated 10 amp., 115 v.; 5 amp., 220 v. or 3 amp. 440 v., a.c. It will satisfactorily operate a ½ hp. motor load, a 1,000 watt heater load or a 250-watt lamp load. Time scales of 0 to 15, 30, 60 or 120 sec.; of 0 to 5, 10, 15, 30 or 60 minutes; or 0 to 2 or 5 hr. are available.

Floor Hardener Provides Smooth, Oil-Proof, Dustless Surface

A varnish type transparent concrete floor hardener and finishing material has been revived by the Truscon Laboratories, Detroit, Mich. It provides an easy-to-clean, oil-proof, dustless surface on cement floors. Known as Granitex, it fills the pours of concrete. No chemical action takes place.

TRADE PUBLICATIONS

CYLINDERS Detailed drawings and specifications of cylinders for air or hydraulic systems are given in Bulletin 82, published by Galland-Henning Mfg. Co., Milwaukee, Wis.

COMBUSTION PROTECTION The Brown Instrument Co., Wayne & Roberts Aves., Philadelphia, Pa., has recently published a bulletin "Brown Protectoglo Combustion Safeguard Systems" showing methods of protection against failure of oil, powdered coal and gas flames. Schematic diagrams illustrate various installations.

GEAR CHECKING The checking of internal gears on involute measuring machines is illustrated and described in a supplemental circular released by the Fellows Gear Shaper Co., Springfield, Vt.

LIFT TRUCKS Detailed specifications on gasoline powered lift trucks with capacities from 2,000 to 10,000 lb. are detailed in a 26-page book "Facts about Towmotor", published by Towmotor Co., 1201 E. 152nd St., Cleveland, Ohio. On each page there is a discussion of one problem of industrial handling.

MACHINE TOOL MOTORS Fractional-horsepower motors for machine tools and other industrial applications are described in a two-page catalog insert No. GEA-3579 by General Electric Co., Schenectady, N. Y.

MATERIALS HANDLING Electric and controls in typical materials handling operations are discussed in a 20-page booklet. B-2264, published by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

METAL DATA Forty engineering data sheets, published since 1934 by Ampco Metal, Inc., 1745 So. 38th St., Milwaukee, Wis., are reproduced in a 56-page booklet issued by the company.

OILSTONE FILES India and hard Arkansas oilstone files are described in a folder being circulated by Behr-Manning, Troy, N. Y.

SHOP EQUIPMENT Lyon Metal Products, Inc., 3011 Clark St., Aurora, Ill., has released a 40-page illustrated catalog of steel shop equipment.

SPECTROGRAPHIC ANALYSIS Spectrographic analysis equipment and its uses in modern analysis of metals and other items are listed in a 16-page catalog, No. 107, published by Harry W. Dietert Co., 9330 Roselawn Ave., Detroit, Mich.

TEMPERING AND DRAWING Suggestions on how to improve tempering and drawing results are included in a bulletin, No. 83, being circulated by the Despatch Oven Co., Minneapolis, Minn.

TOOLS Specifications of Tantung "G" inserted tooth milling cutter blades and all-purpose lathe tools are included in two bulletins published by Vascoloy-Ramet Corp., North Chicago, Ill. Bulletin G-408, also contains drawings and dimensions of 9 milling cutter blades. Bulletin G-409 covers the all-purpose tools.

V-BELTS Allis-Chalmers Mfg. Co., Milwaukee, Wis., is circulating an 8-page bulletin B-6190 describing V-belt performance and listing correct sizes of its Tex-Rope line for industrial applications.

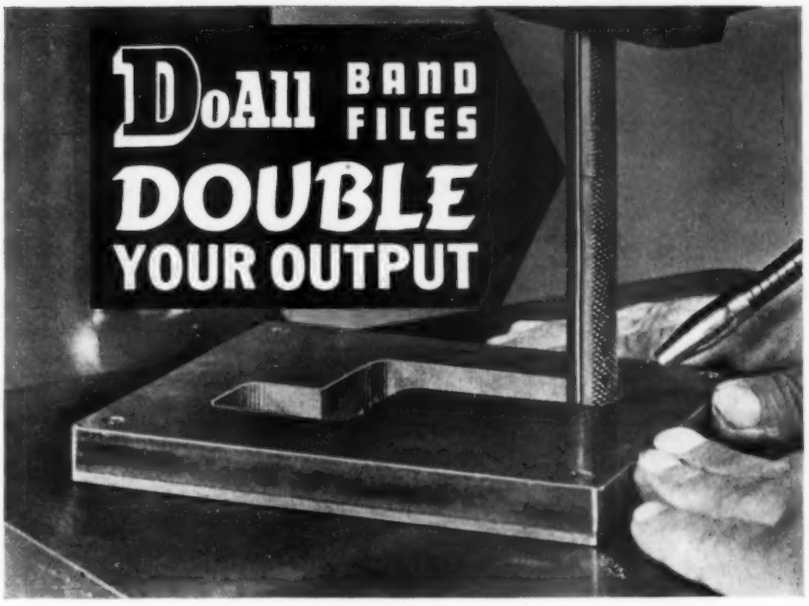
WELDING ELECTRODE A two-page catalog insert, GEA-3493, describing an electrode for cast iron welding, is being circulated by the General Electric Co., Schenectady, N. Y.

WELDING GENERATORS Motor generators with ratings from 750 to 1,500 amp. for use in constant potential d.c. welding systems are described in a new 8-page booklet by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

GAGING ACCESSORIES A 24-page catalog (No. 6706-A) of thermometer and pressure gage accessories, has been published by the Brown Instrument Co., Wayne & Robert Aves., Philadelphia, Pa.

FOUNDRY OVENS Ovens for heat-treating, core baking and mold drying are described in a 16-page Catalog No. 108, circulated by the Gehnrich Corporation, Skillman Ave. & 35th St., Long Island City, N. Y.

EQUIPMENT Products manufactured by the American Locomotive Co., 30 Church St., New York, N. Y., are listed in the company's Bulletin No. 1030.



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Speaking of continuous filing, here's a wheelbarrow of chips, cut by one 3/8" DoAll File Band from 1" thick tool steel. The file was still in good condition.

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Associated with Continental Machines, Inc., Minneapolis, Minn.

plain cylindrical grinders cost less only because they are stripped of all features not used on normal production. Soundly and rigidly constructed throughout they produce accurate work with a high finish. Easy and fast to operate they can be tended by women or boys, should this ever be necessary. If your work does not require features like rapid traverse and full automatic cycles, save their cost, and invest in essentials. Fitchburg Type A Grinders have all the essentials. Two sizes, 6″ x 18″ and 6″ x 32″, fully described in new illustrated booklet free to executives. Write for it today on your business letterhead.

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Falulah Road, Fitchburg, Mass.

NEW BOOKS

MACHINE SAVES BLUEPRINT READING—*By Russell W. Ihn, assistant state supervisor of industrial education for Indiana, and Walter E. Streeter, industrial engineer, Aluminum Company of America.* 138 *pages. Plastic ring binding. Published by American Technical Society, Drexel Ave. at* 58th *St., Chicago, Ill.* $2.00.

One of the problems of the emergency program is getting newcomers to industry to understand the written language of engineering, that is, the use of blueprints. Books like this are designed to impart this knowledge concisely and practically.

The technique followed by the authors is to use facsimiles of blueprints and, by progressively stepping up from simpler to more complicated drawings, to show the many ways in which machine parts can be specified.

The book is really a working manual; after outlining the general principles of the subject, it contains a series of work sheets with questions concerning each of the blueprints shown. It also includes a glossary of terms and shows engineering conventions commonly used in drafting room practice.

Oil for Carbides

By C. G. WILLIAMS

You make the statement that, "A sulphur chlorinated fatty oil, is used in this operation" (AM—Vol. 84, page 812).

It has been definitely proved that the use of a sulphonated or a sulphur bearing oil for a coolant is detrimental to the life of the carbide in a carbide tipped tool.

The sulphur has an affinity for the carbide, or for the metal of which the carbide is formed, and in conjunction with the heat generated in high speed cutting of metals, will develop a chemical reaction that will break down the cutting edge of the tool; the life of the tip between grinds is shortened to as much as one third of what it should be.

The edge will crumble and become serrated; there will be a slight ridge or sulphur-impregnated built-up portion with a low carbide of the metal in the tip, just back of the point where the chip leaves the tip. Even pure water or any other coolant will give a longer life to the tool if it has no sulphur in it.

Screw Thread Standards Revised

Galley proof of a new and enlarged edition of Screw-Thread Standards for Federal Services has recently been received by the Interdepartmental Screw Thread Committee. The new edition will be designated as Handbook H28, and will supersede H25, of which 14,000 copies have been sold by the Superintendent of Documents, Government Printing Office, since March 1940.

The Interdepartmental Committee has cooperated closely with industry and with the Sectional Committee on Standardization and Unification of Screw Threads organized under the procedure of the American Standards Association, and the new publication, H28, will be in substantial agreement with the American Standard ASA B1.1-1935, and certain supplementary standards soon to be issued. In addition to definitions, a classification of screw thread fits, with dimensions and tolerances for each class, it will contain revised sections on gages and gaging, pipe threads, Acme and other translating threads, and new sections on aeronautic screw threads, bolt and machine screw heads, nuts, wrench openings, and a series of recommended tap-drill sizes.

In the section on gages and gaging an attempt has been made to overcome certain objections that have been raised by manufacturers of bolts and nuts to the design and use of not-go gages as presented in H25 and in the 1933 Report of the National Screw Thread Commission on which H25 was based. How effective this attempt may prove to have been must await experience of the next few months or years.

While it has been found impracticable to yield to manufacturers of screw thread products all of the concessions in the way of gage design and gage use which some manufacturers think necessary, and at the same time to safeguard the interests of the user, it has been possible to liberalize somewhat the gaging practice as regards not-go gages used in the inspection of products made to Class 1 tolerances, such as ordinary tonnage bolts and nuts.

On threaded products purchased under rigid dimensional specifications, by the government agencies, departure from recognized practice in the design and use of gages will not be permitted. On the other hand, in the case of products purchased on a performance basis, such as automobiles, trucks, tanks, the manufacturer is free to use such methods of production and inspection as he has found best suited to his needs. The government is concerned only with seeing to it that the finished product fully meets the performance specifications under which it is furnished.

Cast Shanks for Carbides

Time and cost savings are being effected in many machine shops today as a result of a recent development in the application of Meehanite metal for sintered carbide tool shanks. A problem, now particularly costly from the time standpoint, has been the breaking of tool shanks on multiple-tool heavy duty lathes. It is generally assumed that tool shank fractures are

mainly caused by vibration. The damping qualities of Meehanite absorbs vibratory stresses and reduces tool chatter and breakage. Furthermore, because the coefficient of expansion of sintered carbide more nearly approaches that of Meehanite than it does that of steel, heat conductivity is improved with corresponding reduction of expansion stresses in service.

An example of the type of service which such shanks are giving is found in the experience of the tool grinding department of The Copper-Bessemer Corporation. A Carboloy-tipped Meehanite iron tool shank was put in service and performance was as follows: 35 hours at 217 surface ft. per min. on high grade Meehanite castings and 8 hours at 389 surface ft. per min. on chilled castings. It was then ground and gave 16 hours at 245 surface ft. per min. and 24 hours at 210 surface ft. per min. on high grade Meehanite castings. Subsequently this tool ran 359 hours.

It has also been found that these shanks may be ground efficiently because silicon-carbide wheels load up more rapidly with steel.

The Protection of Machinery Against Sabotage

By JOHN EDGAR HOOVER, DIRECTOR
Federal Bureau of Investigation
United States Department of Justice

For years special agents of the Federal Bureau of Investigation have faced the kidnapper, the bank robber and others of their kind in a fight to make America safe for its law-abiding citizens. Through perseverance and close attention to detail the activities of these enemies of society have been sharply curtailed. Today the FBI is engaged in a smiliar struggle against the spy and the saboteur. Cunning and malicious, these enemies of our democracy are being combated successfully on a nationwide basis by trained special agents of the FBI aided by the 150,000 police officers of America.

One outstanding feature of the FBI's current national defense work is its preventive aspect as exemplified in the widespread plant survey program undertaken in the fall of 1939 at the request of the War and Navy Departments. Defects in the protective facilities of plants have been pointed out to the managements, and the latter have cooperated in excellent fashion to close up the loopholes through which the spy or the saboteur might strike. Legitimate labor relationships do not enter into the picture.

The vital machinery of every plant offers a particularly difficult protective problem and one which has not always been successfully solved by industry. In one plant surveyed by a special agent of the FBI, the engine room was considered the most vulnerable as well as the most important section of the establishment. Though only the owner

War machines and munitions have to be good to stand up under war conditions. They must be made rapidly in huge quantities by a variety of plants. All parts must be strictly interchangeable.

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and two machinists were authorized to enter, practically no precautions were taken to keep total strangers out. In fact, the door leading to an uninclosed area behind the plant had a thin piece of wood which turned on a nail as its only locking device.

The saboteur's aim is to disrupt the flow of materials from a plant, and this frequently can be accomplished in one operation if certain pieces of machinery are paralyzed. A handful of worthless filings could readily do thousands of dollars worth of damage and delay production for days or even weeks. Breakage, manipulation of a key part, explosion, fire, or the introduction of abrasives or chemicals into precision parts, fuel or lubricants are other possibilities.

While the machinery of any industrial plant presents its own peculiar problems, there are certain general considerations applicable to the entire field. Machine shops and places where machinery and other precision equipment are located should by all means be considered restricted areas and so designated by appropriate signs strategically located. Persons authorized to enter such areas should be strictly limited to those having official business therein. The practice of issuing employees, entitled to enter, badges strikingly different in color from those of other employees has been found effective. It is desirable also that employees on duty in restricted areas be impressed with the fact that they should accost anyone present in the area without authority.

If the building housing the machinery is a machine shop, of course the entire building will be considered a restricted area. It should be of substantial construction, and the windows, doors and other apertures should be covered with heavy wire screening. When the machinery is not in use, it is desirable that the building be securely locked, and the guard force instructed to make frequent inspections. It is advisable to have the interior lighted at all times so that anyone within can be readily identified.

In the event machinery is located in a building which is also used for other purposes, consideration should be given to inclosing the machinery area with a heavy mesh fence extending from the floor to the ceiling. In this manner the restricted area will be a clearly defined separate unit.

Everything possible should be done to thwart the saboteur if he does gain access to the machinery. Tools, waste and miscellaneous equipment which might aid him in his mission should be securely locked in heavily constructed cabinets or lockers. Abrasive material such as sand and metal filings should not be kept in the vicinity.

The saboteur's skill in attacking machinery can be successfully combated only by the exercise of greater ingenuity in fortifying our American industrial facilities. It is a problem which must be approached in an intelligent manner and carried out with resolution.